

WALTER FREITAG WINS ALTAIR^{T.M.} AT STUDENT FAIR

What does a 15-year-old do with an Altair?

Walter Freitag of Dresher, Pennsylvania, isn't sure what he's going to do with his Altair but judging from his application programs for "Computer Prediction of the Spread of Fire," he'll do some astonishing things.

Walter, a recently graduated 9th grader from Sandy Run Junior High, was the grand prize winner of the recent Student Computer Fair, held concurrently with the National Computer Conference in New York. He was one of 50 students from all over the United States who had an exhibit at the Fair -- which was judged the best Student Fair ever, and one of the highlights of the NCC.

Walter's winning entry included five application programs, written in BASIC on a UNIVAC 1108 timesharing system. According to the extensive documentation that Walter supplied with his exhibit, his project "is an investigation of a possible method for using a computer to predict the propagation pattern of a fire ignited at any point in any given structure. The method under investigation involves a pictorial

representation of the structure, stored on a three-dimensional matrix, showing where combustible matter is and is not present. A series of other matrices, superimposed on this 'structure' matrix, stores numerical data representing the combustion and thermal properties of the materials of the structure. This project explores ways of manipulating this data to show spread patterns of fire in the structure."

The grand prize, which was supplied by MITS as one of the sponsors of this year's Student Fair, included an Altair 8800 kit, 4K memory board, serial I/O board, and Altair 4K BASIC. Walter's father, a chemist at Univac, was at the MITS booth following the award presentation, looking at an ASR33 Teletype and wondering out loud how long it would be before his son will want a floppy disk.

According to Dr. Selma Marks, chairperson of the Fair, 300 entries were received and these had to be narrowed to 50 because of available exhibit space. Among this year's entries were over 20 interactive demonstrations of computer games, simulations and compilers, including



Walter Freitag, Grand Prize Winner
NCC Student Computer Fair

Walter's exhibit, "computer pinball," "A Computerized Analysis of Relative Returns on Stocks and bonds for 1966-75," "Computer Simulation Monopoly," and "Programs to Compute the Orbit and Orbital Parameters of a Comet as it Travels Around a Sun."

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Altair Draws Crowds at NCC

by David Bunnell

34,000 people were at the recent National Computer Conference in New York City and close to 10,000 of them stopped at the MITS booth to take a look at the new Altair 8800b and 680b microcomputers.

There were 943 booths on three floors of



NCC Visitors at MITS Exhibit

the New York Coliseum exhibiting everything imaginable in the computer industry from line printers that hum "Old MacDonald Had a Farm" to "Captain Video" handsize CRT terminals to IBM's newest grocery checkout stand. There were also plenty of non-industry attention getters such as jugglers, card sharks and belly dancers. The show was the biggest computer exhibition in the United States since 1969, and was proof that as far as the computer industry is concerned, the recession is over.

With the exception of the Data General Circus, which included a horse-drawn calliope in the streets in front of the Coliseum and a circus-like exhibit inside - complete with ringmaster and belly dancer with a micro-nova in her navel, it was this reporter's observation that the MITS booth was the busiest booth at the show. The reason for this centered around the new Altair equipment, with most attention on the Altair 8800b,

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I Guess I'll be Reading the *Luddite Worker*

by David Bunnell

Dear David,

Though I understand your feelings, I know some trees who don't.

Mike Rivers
Springfield, Mass.

The above letter was in response to my column in the April issue of C.N., in which I stated that I could never accept the electronic newspaper. My attitude hasn't changed on this subject, but more and more it looks as if I'll have little choice.

According to Murray Turoff of the New Jersey Institute of Technology, hardcopy newspapers will not exist by the year 2000, with the New York Times being computerized as early as 1993. (see Computerworld, June 14, 1976)

Murray, who was part of an NCC panel discussion on the subject of "Information Processing in the Year 2000," went on to say, "By the year 2000, the only hardcopy newspaper left will be the Luddite Worker."

For the benefit of you history buffs, the Luddites were a group of 19th century English workers who destroyed labor-saving machinery in

protest of the modern age. As far as I know, the movement fizzled out long ago, however, if some of the things the panelists talked about come true, it could be revived.

According to another panelist, Margaret Butler of the Argonne National Laboratory, most white collar workers will work at home, using their home communication system to confer with fellow workers. This would allow people to live wherever they wanted and it could conceivably end big city commuter problems. No more traffic jams. That would be nice.

The problem is that these ideas disrupt normal life patterns. While it would be neat to live on a Himalaya mountain while continuing to work for the Android Computer Company of Los Angeles, I wonder how my wife and kids will respond to having me around the house all day.

And you can imagine what the boss would think when I have to excuse myself from a staff meeting to change my son's diapers or resolve some family problem. Somehow, the image of Daddy, still in his pajamas, sitting in the home computer room from 8 til 5, just doesn't register. And if Mommy works too, I guess we'll

have to be a two-computer-room family.

Oh well, the company picnic will be fun.

The idea of a home computer system that gives me access to whole libraries of information and provides automated shopping services, consumer advisory service, medical counseling, etc. is truly significant and I'm looking forward to it. However, it is beyond me how distinguished academics can so passively speak of technological advances that will completely alter life styles and the way people relate to each other socially. This talk seems to be rather naive.

It is conceivable, I suppose, that someday people will no longer need arms and legs -- we will just sit before our home computers, which will instantly deliver whatever our imagination desires. Mankind will simply evolve into a race of intelligent weebles.

As for me, I'll be in an underground cave somewhere, surrounded by ancient printing presses, putting out yet another edition of the Luddite Worker.

customer service news

By Gale Schonfeld

Those of us in the Customer Service Department take the word "service" very seriously. This month, I'd like to elaborate on some of our "departmental procedures," in an effort to narrow any communication gaps between the Customers and Customer Service.

(1) TYA - TYK - TYR

Our allotment for the special Teletypetm offer has been completely filled until September, and no more deliveries will be made until that time. Customers with pending orders will be advised of projected ship dates. Thank you for your overwhelming response!

Listed below are the policies we have set in regard to the TYA, TYK and TYR orders.

(a) ALL TYA, TYK and TYR orders are to be PREPAID.

(b) All TYA, TYK, TYR orders will be entered as separate orders. If you send in an order for several items, it will be split into two orders and you will receive two order acknowledgements - one for

the Teletype special and one for the other items.

(c) Cancellations on TYA, TYK, TYR orders cannot be guaranteed if the order has already been sent to Teletype Corporation. A refund or credit to your account cannot be issued until we receive written verification of the cancellation from Teletype Corporation. All requests for cancellations should be made to MITS, not to Teletype Corporation.

(d) If your Teletype special has been shipped and you decide to cancel, you will still be responsible for the freight charges from Teletype Corporation to you. The unit must then be returned to MITS (NOT Teletype Corporation), freight charges prepaid.

(e) Shipments must always be accepted from the freighter. If damage is suspected, please inspect the shipment thoroughly and contact MITS IMMEDIATELY.

(f) Please contact MITS in regard to ALL questions on TYA, TYK, TYR orders or service of units. DO NOT CONTACT TELETYPE CORPORATION.

(g) The guarantee on Teletypes is 120 days for parts and labor against physical defects or workmanship by Teletype Corporation, effective from the date of receipt of the unit from Teletype Corporation. Modifications on these units will void your warranty. Please contact MITS for

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COMPUTER NOTES

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NCC

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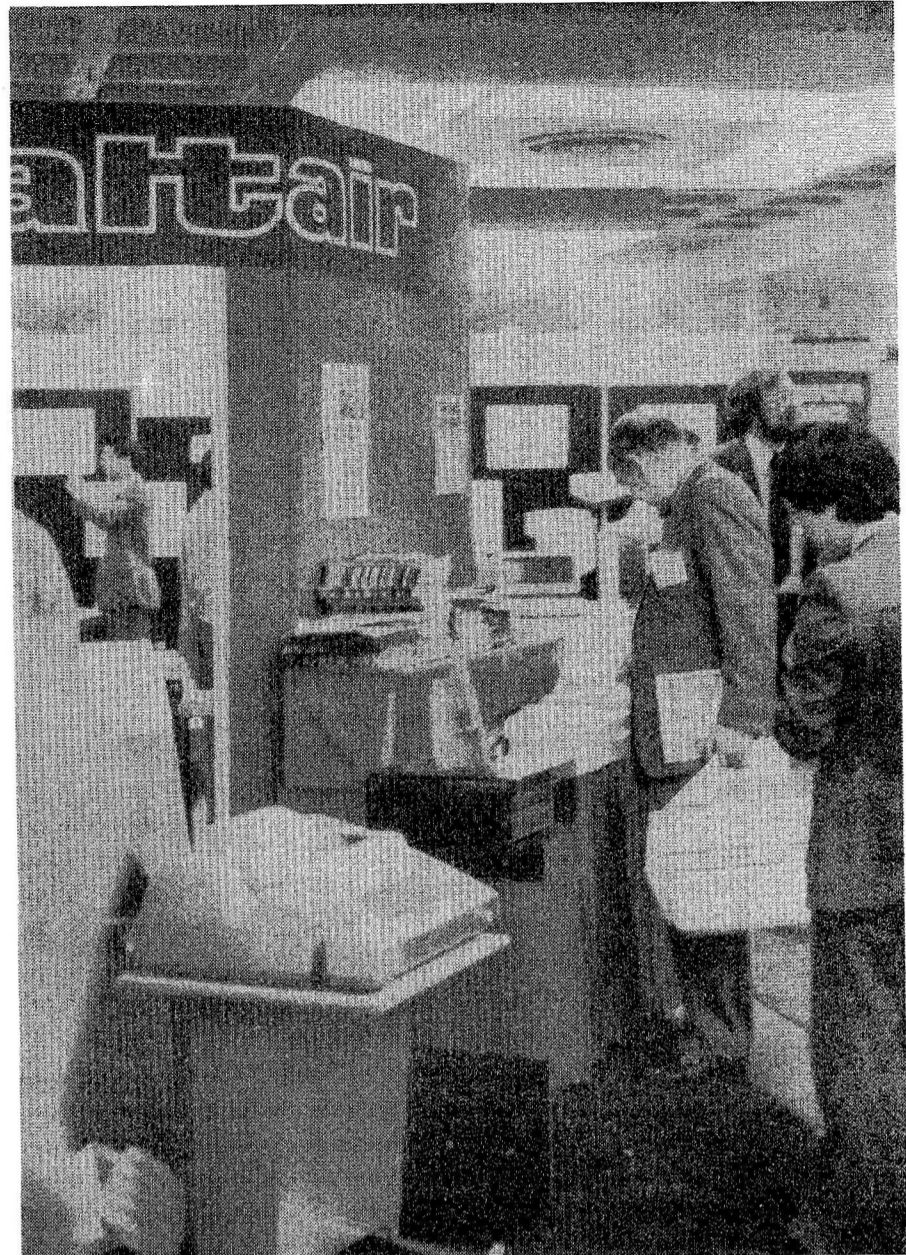
Altair 680b and the Altair 16K static cards for both the 8800 and 680 machines.

Mits demonstrated four operating Altair systems including the following:

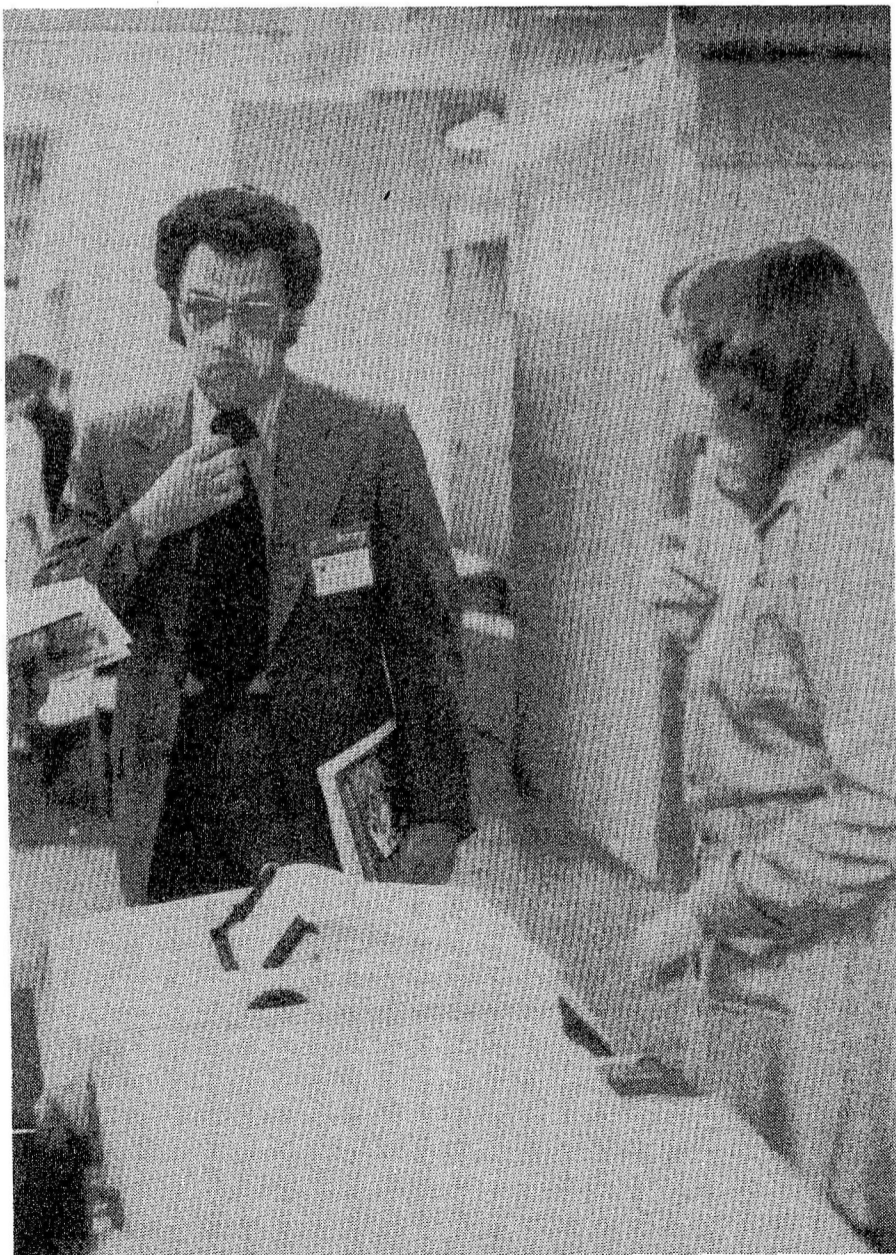
1. Altair 8800b (56K memory, RS232 interface, LP interface, disk controller, PROM board with disk loader), CRT terminal, Altair Line Printer, dual Altair Disk Drives, and Altair Disk Extended BASIC.
2. Altair 680b with 33K of memory, CRT terminal, Altair High Speed Paper Tape Reader, and Altair 680 BASIC.
3. Altair 8800b (60K memory, RS232 interface, disk controller, PROM board with disk loader), ASR33 Teletypetm, Comter II, Altair Disk Drive, and Altair Disk Extended BASIC.
4. Altair 680b with 33K of memory, ASR33 Teletype, and Altair 680 BASIC.

In addition to the new equipment, Mits announced the opening of their latest Altair computer center, The Computer Store of New York City. According to store manager Bob Arning, the opening was very successful, thanks in part to spillover from the NCC. The new Computer Store is located between 5th and 6th Avenue at 55 West 39th Street. The phone number is 212-221-1404.

The 1977 NCC is slated to be held in Dallas, where it is Mits' intention to steal "The Show of the Show" from Data General by exhibiting a minimum of 20 operational Altair systems. This will be accomplished without belly dancers, calliope or sword swallowers. (Although, we may have a dancing penguin, or 48 Altairs stuffed in a Volkswagen, or)



Altair Display Attracts 10,000 People



33K in that little thing?



*Leslie Heller Presents Dance
Interpretation of Computer Symbols*

STAR TREK LIVES!

by Lynn Cochran Reprinted from *Interface* June, 1976

Lynn Cochran, a graduate of Cal Poly, Pomona, has been active in amateur radio including the design of digital controls for repeater systems, and has recently become involved in the hobby computer field. He is presently employed in San Francisco as a communications engineer for a large oil corporation.

The computer game of STARTREK (based on NBC's popular TV show) has appeared in many versions since the late sixties. Among the most popular versions are those written by Mike Mayfield in the HP contributed program library, and by David Ahl in the book 101 BASIC COMPUTER GAMES.

These instructions are for a version of STARTREK optimized for use with MITS 8-K BASIC (a listing of the program is included). I rewrote it to fit in a minimum of memory with the result that it just fits in my 12-K Altair 8800 system with the 8-K Basic interpreter (version 3.1). In rewriting it to get it to fit within 12-K, I've combined the "Warp Engines" and "Photon Torpedoes" routines, left out printed-out instructions, and eliminated the "Status Report" command (each device now tells you how many years are required for its repair when you try to use it). It also runs a little slower than on the big machines; it takes about 4 seconds to set up a new Quadrant, and a whole 10 seconds to initialize the Galaxy, but the feeling you get from saving the known universe makes it worth it. Running this program is also a good way to test memory; it finds problems no memory-checker program will (it uses just about everything). It would be a good bet to put your best memory in the bottom 8-K to minimize the fatality of any 'memory lapses.' The program does not use ATN, so Basic can be initialized without it if memory space is needed.

I have included a 'Block Diagram' of the STARTREK program which provides, on one page, an idea of how the program works. The diagram shouldn't be taken too literally; not shown are the damaged device routines, or the fact that the "Warp Engines" and "Torpedo" commands are processed by a single routine. (Block Diagram--page 18)

Also included is a list of the variables used in the program; they may come in handy if you try to decipher the strange techniques I've used to crunch STARTREK into 12-K of memory.

Because I feel that other people may want access to copies of this program, either to modify for their own use, or to use as is, I want to see this program freely distributed.

Lynn Cochran

INSTRUCTIONS FOR STARTREK

It is Stardate 3421 and the Federation is being invaded by a band of Klingon "pirates" whose objective is to test our defenses. If even one survives the trial period, Klingon Headquarters will launch an all out attack. As Captain of the Federation Starship 'ENTERPRISE', your mission is to find and destroy the invaders before the time runs out.

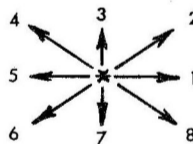
The known galaxy is divided into 64 quadrants arranged like a square checkerboard, 8 on a side. Each quadrant is likewise divided into 64 sectors arranged as an 8 by 8 square. Each sector can contain a Klingon (K), star (*), Starbase (B), the Enterprise herself (E), or empty space (.). Each sector is also numbered; a Starbase in sector 3-5 is 3 rows down from the top of the Short Range Scan printout, and 5 sectors to the right. Docking at a Starbase is done by occupying an adjacent sector, and reprovisions your Starship with energy and photon torpedoes, as well as repairing all damages.

Your Starship will act on the following commands:

Command 1

Warp Engine Control is used to move the Enterprise. You will be asked to set the distance (measured in Warps), and the course for the move. Each move that you make with the Enterprise from one sector to another, or from one quadrant to another, costs you one stardate (one year). Therefore, a 30 year game means you have 30 moves to win it in.

Course--A number from 1 to 8.999 indicating a direction (starting with a 1 to the right and increasing counterclockwise). To move to the left, use a course of 5. (A course of 3.4 is halfway between 3 and 4; a course of 8.75 is three-quarters of the way from 8 to 1.



Warp--One Warp moves you the width of a quadrant. A warp of .5 will move you halfway through a quadrant; moving diagonally across a quadrant to the next will require 1.414 Warps. Warp 3 will move you 3 quadrants providing nothing in your present quadrant blocks your exit. Once you leave the quadrant that you were in, you will enter Hyperspace; coming out of Hyperspace will place you randomly in the new quadrant. Klingons in a given quadrant will fire at you whenever you leave, enter, or move within that quadrant. Entering a course or warp of zero can be used to return to the command mode.

Command 2

A Short Range Sensor will print out the quadrant you presently occupy showing the content of each of the 64 sectors, as well as other pertinent information.

Command 3

The Long Range Sensor Scan summarizes the quadrant you are in, and the adjoining ones. Each quadrant is represented as a 3-digit number; the first (hundreds) digit is the number of Klingons in that quadrant while the middle digit is the number of Starbases, and the units digit is the number of stars. An entry of 305 means 3 Klingons, no Starbases, and 5 stars.

Command 4

Fire Phasers; the portion of the Enterprise's energy that you specify will be divided evenly among the Klingons in the quadrant and fired at them. Surviving Klingons will retaliate. Phaser fire bypasses stars and Starbases, but is attenuated by the distance it travels. The arriving energy depletes the shield power of its target. Energy is automatically diverted to the shields as needed, but if you run out of energy, you'll get fried.

Command 5

Photon Torpedo Control will launch a torpedo on a course you specify which will destroy any object in its path. Range is limited to the local quadrant. Expect return fire from surviving Klingons.

Command 6

The Galactic Records Section of the ship's computer responds to this command by printing out a galactic map showing the results of all previous sensor scans.

VARIABLES USED WITHIN THE STARTREK PROGRAM

A = Command:	A=0	Just arrived in quadrant
	A=1	Warp Engine Control
	A=2	Short Range Sensor Scan
	A=3	Long Range Sensor Scan
	A=4	Phaser Control
	A=5	Photon Torpedo Control
	A=6	Print Galactic Map

E = Present energy

E0 = Initial energy

P = Number of torpedoes left

P0 = Initial number of torpedoes

T = Present year

T0 = Starting year

T9 = Ending year

K = Number of Klingons in present quadrant

K9 = Total number of Klingons in the galaxy

B = Number of Starbases in present quadrant (one or zero)

B9 = Total number of Starbases in the galaxy

S = Number of stars in present quadrant

S9 = Initial energy of each Klingon

C = Course entered by player

W = Warp entered by player

H = Hit on Enterprise or Klingon in units of energy

I,J = Matrix variables in FOR-NEXT statements

N,X,Y,X1,Y1,X2,Y2 = Multiple-use variables

S1,S2 = Enterprise sector coordinates (down, right)

Q1,Q2 = Enterprise quadrant coordinates (down, right)

Q\$ = Characters used in printing a Short Range Scan (EKB*)

C\$ = Condition; Green, Yellow, Red, or Docked

E\$ = Multiple-use string variable

D(I) = Number of years for repair of each device where the value of I determines the device.

D\$(I) = Descriptive character string for each device where the value of I determines the device. See statements 30 through 70.

The value of I for each device is:

- I=0 Warp Engines
- I=1 Short Range Sensors
- I=2 Long Range Sensors
- I=3 Phasers
- I=4 Photon Torpedoes
- I=5 Galactic Records

K1(I) = Sector coordinate (down) for Ith Klingon in quadrant

K2(I) = Sector coordinate (right) for Ith Klingon in quadrant

K3(I) = Units of energy left in Ith Klingon in quadrant

S(I,J) = Sector Matrix. The values of both I and J are permitted to range from 0 to 7. Together, a given set of values for I and J selects one of the 64 stored numbers that the dimensioned variable S(I,J) has. S(I,J) is used to store the contents of the 64 sectors of the quadrant that the Enterprise is presently in. When the sector is printed out using the Short Range Scan, the value of I associated with each sector determines how far down from the top that sector is printed, while the value of J determines how far to the right it is printed. The contents of each element in the matrix S(I,J) determines what is printed in the associated sector:

- 1=Empty space (.)
- 2=Enterprise (E)
- 3=Klingon (K)
- 4=Starbase (B)
- 5=Star (*)

Q(I,J) = Quadrant Matrix. Like the sector matrix, this matrix is also defined to have 64 elements; each one stores a number which indicates how many Klingons, Starbases, and stars are in the associated quadrant. No attempt is made to store actual positions of Klingons, Starbases, or stars in any quadrant but the one that the Enterprise is currently in. For the remaining quadrants, only the number of Klingons, Starbases, and stars are stored (in the quadrant matrix).

When the enterprise moves to a new quadrant, the number of Klingons, Starbases, and stars for that quadrant are looked up in the quadrant matrix, and then that many Klingons, Starbases, and stars are randomly positioned along with the Enterprise in the sector matrix when the new quadrant is set up (statements 230 to 300). The numbers stored in the quadrant matrix are what are printed out when Long Range Scans and Galactic maps are printed. When the galaxy is first set up, each element in the quadrant matrix has a negative value. As the Enterprise roams the galaxy scanning quadrants, the values for those quadrants are made positive. The Galactic Map routine (statements 1300 to 1350) only prints positive valued quadrants; i.e. only those previously scanned by the Enterprise. Typical values stored for a quadrant are:

-305 means unexplored, 3 Klingons, no Starbases, and 5 stars

16 means mapped by sensors, no Klingons, 1 Starbase, and 6 stars

See Page 18 for STAR TREK Program Listing

Walter Freitag - continued from page 1

Two students, Robert Bediehek of Scarsdale, New York and Lane Malpus of South Daytona, Florida, demonstrated homebrew computers that they designed and constructed from scratch.

Other highlights of the Student Fair included a computer dance routine by Leslie Heller, which demonstrated what computer symbols would look like if they became animated, and an original piano composition entitled "Computer Boogie" by Stephen Basili.

Other prize winners at the Student Fair included: William Blum for "Digital Controls in Electronic Music Synthesis," a \$250 prize contributed by the New York chapter of ACM; Rand Miller for "Swarms," a computer game based on the book The Swarm by Arthur Herzog that simulates an attack on the United States by the African hybrid bees, prize -- an HP25 contributed by Hewlett Packard; and Glenn Poole, also winning an HP25, for "A Probabilistic Approach to Computer Creativity." Eight students won \$100 savings bonds, and 17 students won \$25 savings bonds.

Altair Users

Samuel R. Hunt
4711 Olley Lane
Fairfax, VA 22030

C. N. Burton MSgt.
601 Tac Con Gp Box 1653
APO New York, NY 09130

M. Douglas Callihan
Berkley Street RFD #1
Berkley, MA 02780

SFC John C. Harper
578 Signal Company
APO New York, NY 09131

Sgt. Ray D. Congdon
6226 Deer Valley
San Antonio, TX 78242

Charles Skeldon
2320 W. Co. Rd. I#3
New Brighton, MN 55112

Local Tinkerer Opens Albuquerque Computer Store

Following are excerpts from an article that appeared in the June 4, 1976, issue of *The New Mexico Independent*. The article, written by Nels Winkless III, centered on the emergence of a new Altair computer store in Albuquerque, N. M. and its proprietor, Pete Conner.

-Ed.

Pete Conner, departing regular pay at Singer with mixed feelings, has taken the plunge and opened The Computer Shack here in the lonely wastes of the Rio Grande Valley. The step is a big one. Fewer than 30 computer stores have opened in the entire country, mostly in major metropolitan areas, and there's no long history of operating statistics to guide the new entrepreneur.

FRANTIC LABOR

WE CAUGHT Conner for a talk in the empty store while he frantically labored to build partitions and counters, answer our questions, and deal with calls on his CB radio. Callers and visitors asked repeatedly if the store was open yet. "Not quite," said Conner, "but any time now. Drop in if you like. I'll probably be here til two in the morning and I can talk, anyway."

Conner has never been in the retail business. He's a technical man, an engineer with a broad stripe of hustler and politician in him. He's very active in amateur radio organizations, president of a couple of them in fact. He makes his hardware work for him, carrying his voice and name about the countryside. He's betting that amateur computers are the biggest thing to happen since television reached the consumer market and that he can learn fast enough to do the right things as a retailer.

What does a computer store sell?

Well, computers, to begin with. Conner will handle the complete MITS line of computers and peripherals. He'll also carry the Cromemco line, both the Cyclops camera and the TV Dazzler that lets you control images on a color television set. "We'll probably have that display right up in the window," says Conner with a thoughtful glitter in his eyes. "Everybody likes to watch that display."

HE'LL CARRY Pertec floppy discs, Teletype terminals, probably Lear-Siegler and Super-Bee video terminals, and all of the basic electronics logic and components that seem necessary to computers. The customer who knows what he is doing will be able to buy components (including National Semiconductor micropro-

cessor boards and kits) that let him assemble computers from scratch.

And if you don't know what you're doing? You've come to the right place. Conner and his troops will lead you by the hand through all of the mysteries and do their best to get you addicted to computers.

One thing Conner can offer that the mail-order dealer can't easily provide is service. After you have bought a full system or bought a kit and assembled it, Conner will be available to help you figure out why it doesn't work and do something about it. The Computer Shack will have a shop, some test equipment, and some people with savvy to help you outwit the systems. That matters.

"Yes, we hope that a group of computerwise customers will enjoy hanging around the store to gab with each other and offer help. As a matter of fact, we've arranged for the Albuquerque Computer Club to meet here regularly."

ENGINEERING STRIPE

THERE'S A good, solid engineering stripe left, too. "I've been a designer and builder all my life," says Conner. "I'll have my drafting table here and I expect that a major part of the business will be in designing special systems and hardware. That's been the experience of successful stores in other places. This is still very much a custom business."

Not all of the business will be with hobbyists, probably. Large numbers of small businesses are gazing wistfully at computer systems, wishing they could set up operating systems without have to hock the whole business to raise the money. Conner feels that he can provide custom business systems with programming and hardware designed for particular businesses at very modest cost.

But think of the highschoolers, too, thirsting to get their hands on real computer systems. Conner hopes to persuade their parents that a computer system is not more expensive and is much more satisfactory as a graduation present than a car or a motorcycle. The stratagem, of course, is to let student and parent lay hands on an operating computer system. "We'll have one system, maybe two, operating in the store at all times," Conner says. "You know, hardly anybody who actually gets to play with a computer and make it do something fails to get hooked. As soon as people find out that there's no black magic involved, they want to make the

machine perform under their own control."

. . . and there are the colleges . . .

. . . and anybody else who can be reached through the papers and broadcast media. Conner even has a van equipped with an operating computer that will travel to other cities around the state to spread the addiction. "You know, all kinds of people are playing with computer systems, truck drivers, store clerks, even farmers, as well as people trained in electronics. Apparently a lot of people just want to be current with what's going on in the world and computers are part of it."

customer service news

CONTINUED FROM PAGE 2

the name and location of the Service Center nearest you.

- (h) REMINDER: NO foreign, Alaska or Hawaii orders for the Teletype special will be accepted unless a continental United States "ship to" address is given. (Alaska and Hawaii orders can be accepted if the customer wishes to accept Emery Air Freight Collect shipment.)

(2) Customer Records

Our customer records are usually filed according to the first line of the "Sold To" address on the order acknowledgement. If we have listed you as a company and you would rather be listed as an individual (or vice versa), please let us know and we will be happy to adjust our files.

In reference to this same matter: if you call or write in about an order, please let us know if you are listed as a company or individual, and please quote the name exactly the same way each time. This will expedite our handling of the request and benefit you with quicker and better service.

(3) Change of Address

Last month we included a standard "Change of Address" form in *Computer Notes*. This will be included in all future issues. When sending in this form, please advise as to whether you have any orders outstanding so that we may correct your address prior to shipment.

We have received many favorable comments on our efforts to expand and improve our Customer Service Department. We appreciate your support and ask that you send any suggestions or comments directly to me, Gale Schonfeld. Hope to hear from you soon -- Gale.



Now, you can buy an Altair[®] 8800 or Altair 680 computer kit right off the shelf. Most all Altair options, software and manuals are also available. The MITS Dealer List below is just the beginning:

off the shelf

RETAIL COMPUTER STORE, INC.
410 N.E. 72nd
Seattle, WA 98115
(206) 524-4101

COMPUTER KITS
1044 University Ave.
Berkeley, CA 94710
(415) 845-5300

THE COMPUTER STORE
(Arrowhead Computer Co.)
820 Broadway
Santa Monica, CA 90401
(213) 451-0713

THE COMPUTER SHACK
3120 San Mateo NE
Albuquerque, NM 87110
(505) 883-8282

GATEWAY ELECTRONICS
2839 W. 44th Ave.
Denver, CO 80211
(303) 458-5444

GATEWAY ELECTRONICS
8123-25 Page Blvd.
St. Louis, MO 63130
(314) 427-6116

BYTE'TRONICS
Suite 103 - 1600 Hayes St.
Nashville, TN 37203
(615) 329-1979

CHICAGO COMPUTER STORE
517 Talcott Rd.
Park Ridge, IL 60068
(312) 823-2388

MARSH DATA SYSTEMS
5405-B Southern Comfort Blvd.
Tampa, FL 33614
(813) 886-9890

MICROSYSTEMS
6605A Backlick Rd.
Springfield, VA 22150
(Washington DC area)
(703) 569-1110

THE COMPUTER SYSTEMCENTER
3330 Piedmont Road
Atlanta, GA 30305
(404) 231-1691

THE COMPUTER STORE, INC.
120 Cambridge St.
Burlington, MA 01803
(617) 272-8700

THE COMPUTER STORE OF ANN ARBOR
310 East Washington St.
Ann Arbor, MI 48104
(313) 995-7616

COMPUTER PRODUCTS UNLIMITED
4216 West 12th St.
Little Rock, AR 72204
(501) 666-2839

the COMPUTER STORE, INC.
63 South Main St.
Windsor Locks, CT 06096
(203) 871-1783

the COMPUTER STORE of NEW YORK
55 West 39th St.
New York, NY 10018

THE COMPUTER ROOM
3938 Beau D'Rue Drive
Eagan, MN 55122
(612) 452-2567

NOTE: Altair is a trademark of MITS, Inc.

MITS, Inc. 2450 Alamo S.E. Albuquerque, N.M. 87106

New Products

680-b-BSM 16k Static Memory Card

One of the big hits at the 1976 National Computer Conference was the MITS Altair 680b computer with 33K of memory running MITS Altair 680 BASIC. The memory board that made this possible is the 680b-BSM 16K Static Memory Card. Two 680b-BSM cards were used, providing 32K and the internal 1K of memory provided the additional 1K.

Included with the 680b-BSM and the 680b computer is a free copy of MITS Altair 680 BASIC, Assembler and Text Editor on paper tape. Altair 680 BASIC is virtually identical to the Altair 8800 8K BASIC and operates in about 7K of memory.

The 680b-BSM 16K Static Memory Card has many outstanding features, one of which is its extremely modest power consumption of 5 watts or 38 micro watts per bit. This allows operation of two 16K cards without adding a second power transformer. A DIP switch is used for address selection and test points have been installed at important signal outputs for ease of checkout and troubleshooting. Ferrite beads are used on all common supply lines for noise isolation.

For the kit builder, the use of an epoxy solder mask on areas not to be soldered increases ease of assembly, as well as sockets for all ICs, providing easy installation and removal of ICs. All of these features, plus a well-documented manual with step-by-step assembly instructions and detailed theory and troubleshooting sections, make the 680b-BSM the ideal addition to the MITS 680b computer. The care and effort we have put into the 680b-BSM will be appreciated by hobbyists and professional computer users alike.

If you are ordering the 680b-BSM card and it is your first additional card for the 680b, you will need to order the 680-MB Expander Card. The 680-MB holds up to three cards and includes a 100-pin connector for plugging in to the 680b Main Board.

Also, if you intend to add three cards to your 680b, you will need to install a second power transformer to the 680b back panel in the holes provided.

680b-BSM SPECIFICATIONS

RAM Access Time	215ns maximum
RAM Cycle Time	400ns minimum
+16v current	130ma maximum
-16v current	110ma maximum
+9v current	150ma maximum

Price \$685.00 kit

Delivery 60 days

Altair 680 BASIC, Assembler, Text Editor

Price Free with purchase of Altair 680b and 680b-BSM

Delivery Paper Tape - 60 days

Miscellaneous

680-MB Expander Card	\$24.00 kit
102609 680b Power Transformer	\$9.30

Note: Add postage and handling \$3.00 each for parts and PC boards.

Altair 8800b New Bus Lines

There will be a detailed article on the 8800b in next month's Computer Notes. However, there have been several questions about new bus lines that are being used. They are as follows:

Bus #	Signal
12	XRDY2
55	RTC
56	STSTB
57	DIG1
58	FRDY

XRDY2 and FRDY are additional ready inputs to the CPU board. The READY input to the CPU is now defined as the logical product of four inputs:
 $READY = (PRDY) \text{ AND } (FRDY) \text{ AND } (XRDY) \text{ AND } (XRDY2)$

PRDY is the "old" 8800 bus ready signal.

XRDY is the "old" 8800 bus extra ready signal.

FRDY is the new 8800b front panel ready signal.

XRDY2 is a new 8800b extra ready signal.

RTC is a 60Hz signal used by the Real Time Clock. This signal is used on both the 8800a and 8800b.

STSTB is a strobe signal provided by the 8224 clock generator chip. Its basic function is to strobe the 8212 status latch to allow status signals to be set up as soon as possible. This signal is also used by the 8800b D/C board.

DIG1 is an enabling signal that controls enabling of the CPU Data Input (DI) drivers. The 8800b employs two sets of DI drivers: one is the standard set used by all memory and I/O devices; the other is used exclusively by the D/C board. If we define G1 to be the enable signal for the first set of drivers and G2 to be the enable for the second set:

$G1 = (DIG1) \text{ and } (PDBIN)$

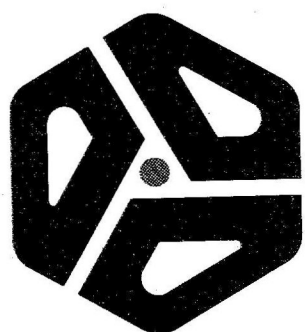
$G2 = (\overline{DIG1}) \text{ and } (PDBIN)$

corrections

Dear Andrea,
 I would like to point out an error in the February issue of Computer Notes, page 14, LED OCTAL DISPLAY. The buss pin numbers for D4, 5, 6 are given incorrectly. Their numbers should read 38, 39, 40. I wish to thank C/N and Prof. Kenneth B. Wiberg for a useful output device.

Martin H. Eastburn
 Arlington, Texas

Last month's Repair Department article on "Troubleshooting 4K Dynamic Boards" contained an error in the Channel 2 waveform diagram. The time between the pulses labeled "900 nsec" should be labeled "400 nsec."



mits

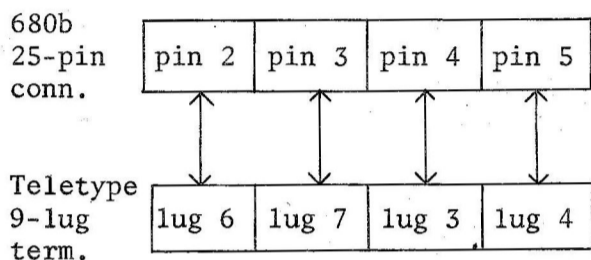
HARDWARE

altair 680-b Hardware Notes

by Steve Pollini

A. Teletype Interconnect

Some 680b users are having hassles when connecting a Teletype to the Altair 680b computer. All of the necessary connections within the computer are clearly explained in the 680b Assembly Manual. However, the terminal strip connections within the Teletype machine itself are not described. The diagram below shows the necessary interconnections between the 25-pin connector on the back panel of the Altair 680b and the 9-lug terminal strip inside the Teletype.



The Teletype must be wired for 20 ma current loop and full duplex operation.

B. RESET Function

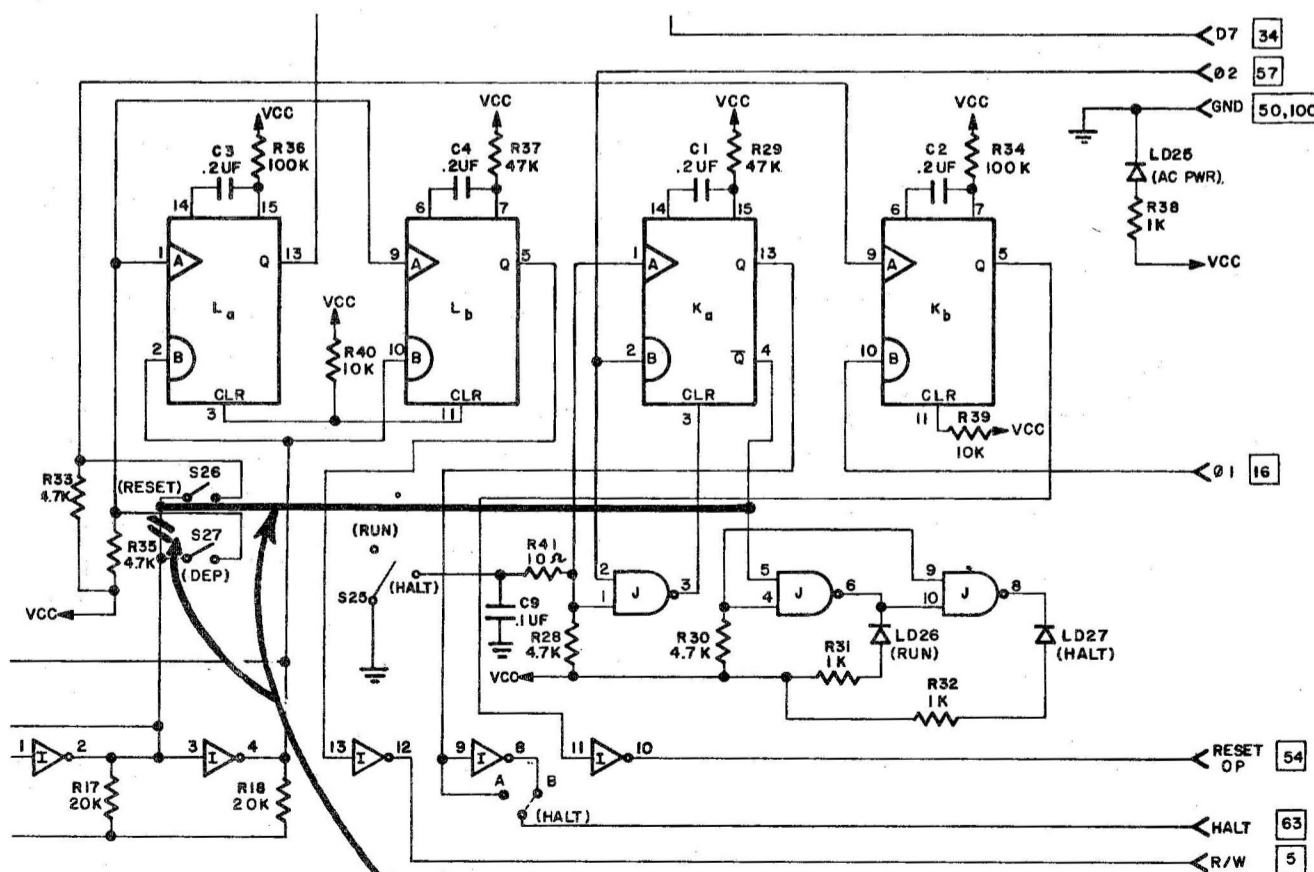
Another aspect of 680b operation that has caused some concern is the RESET function. It is necessary to turn off the computer in order to have it RESET and RUN properly after the processor has entered an undefined state (due to the processor attempting to execute an invalid instruction). The reason that the system cannot be RESET once the processor enters this undefined state

is that the BUS AVAILABLE (BA) signal line will not go high when an attempt is made to HALT the processor. This, in turn, prevents enabling of the front panel RESET function. BA was originally used for front panel enabling because it is valid (high) only when the processor is halted. This prevents the front panel RESET and DEPOSIT functions from interfering with the system while it is running a program.

To permit your computer to perform a master RESET even when the MPU will not halt while the RUN/HALT switch is in the HALT position, perform the following modification to the front panel display board:

1. Delete the signal line that connects the center pins of the RESET and DEPOSIT switches.
2. Delete the signal line from IC I (pins 2 and 3) to the center pin of the RESET switch.
3. Since step 2 also deletes the signal line from the DEPOSIT switch, it is necessary to connect a jumper from the land of IC I (pin 2) to the center pin of the DEPOSIT switch.
4. Connect a jumper from IC K (pin 4) to the center pin of the RESET switch.

The diagram below shows the modification schematically.



Front Panel Display Board Modification
(680 Display Schematic, Sheet 4 of 4)

Now the RESET function of the front panel is no longer contingent upon the state of the BA signal line, but rather upon the state of the RUN/HALT signal line.

In normal operation, IC K_a (pin 13) is high when the processor is in the HALT mode. Pin 4 (\bar{Q}) of IC K is then low. Since a low signal is necessary at IC L_a (pin 1) to effect a RESET, the \bar{Q} output of K_a (pin 4) is fed to the RESET switch. When the processor is in the RUN mode, IC K_a (pin 13) is low and the \bar{Q} output (pin 4) is high. With this high signal present on the RESET switch, no RESET can be effected.

If you wish to initiate a master RESET while the processor is in the RUN or the HALT mode, I recommend following modification steps 1, 2, and 3 above. Instead of jumpering as in step 4, jumper the center pin of the RESET switch to a ground land on the board. Remember, however, that when a RESET is effected while the processor is in the RUN mode, it will then jump back to the Monitor regardless of what program it was previously running.

CLASSIFIED ADS

FOR SALE: Altair 8800 with 8K dynamic RAM and ASR33 Teletype (3JD), all assembled and running BASIC. \$2300.00. Call 916-885-9456 after 5pm Pacific time or write John Teets/1600 Shirland Tract/Auburn, CA 95603

FOR SALE: 1-inch computer tape at bargain prices! Scotch 861 and 871 on 3600' reels in original boxes. List price \$38, my price \$6/reel plus postage. Jim Stitt/311 North Marshall Road/Middletown, OH 45042

Computer Clubs

Vermont Computer Guild
Box 337
Barre, Vermont 05641
802-476-3628
Richard Fadden

Greater Toronto, Hamilton and Kitchener, Ontario areas:
TRACE (Toronto Region Association of Computer Enthusiasts) has over 50 members and meets once a month, usually on the first or second Friday. Write for newsletter: TRACE
Harold Melanson, President
Box 545
Streetsville, Ontario
L5M 2C1

Imagine a microcomputer

Imagine a microcomputer with all the design savvy, ruggedness, and sophistication of the best minicomputers.

Imagine a microcomputer supported by dozens of interface, memory, and processor option boards. One that can be interfaced to an indefinite number of peripheral devices including dual floppy discs, CRT's, line printers, cassette recorders, video displays, paper tape readers, teleprinters, plotters, and custom devices.

Imagine a microcomputer supported by extensive software including Extended BASIC, Disk BASIC, DOS and a complete library of business, developmental, and industrial programs.

Imagine a microcomputer that will do everything a mini will do, only at a fraction of the cost.

You are imagining the Altair 8800b. The Altair 8800b is here today, and it may very well be the mainframe of the 70's.

The Altair 8800b is a second generation design of the most popular microcomputer in the field, the Altair 8800. Built around the 8800A microprocessor, the Altair 8800b is an open ended machine that is compatible with all Altair 8800 hardware and software. It can be configured to match most any system need.

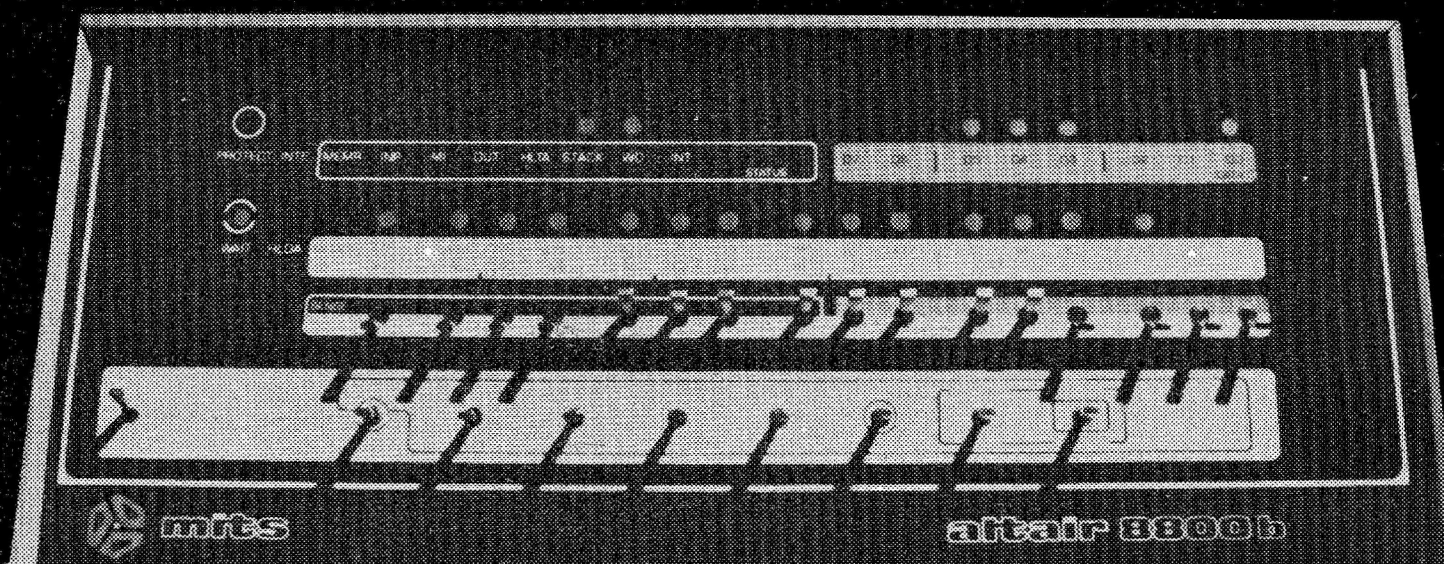
MITS' plug-in compatible boards for the Altair 8800b now include: 4K static memory, 4K dynamic memory, 16K static memory, multi-port serial interface, multi-port parallel interface, audio cassette record interface, vectored interrupt, real time clock, PROM board, multiplexer, A/D convertor, extender card, disc controller, and line printer interface.

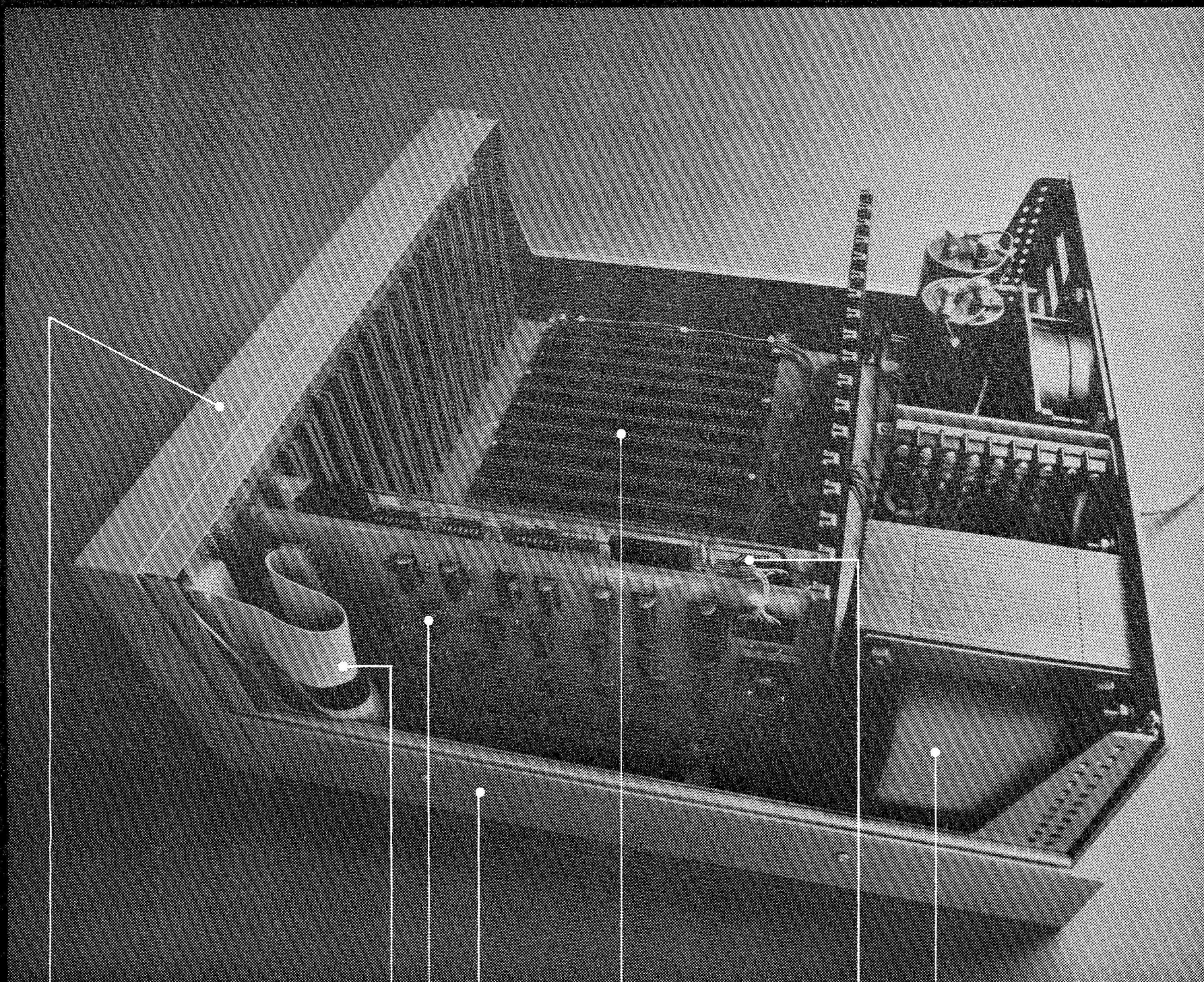
MITS' peripherals for the Altair 8800b include the Altair Floppy Disc, Altair Line Printer, teletypewriters, and the soon-to-be-announced Altair CRT terminal.

Introductory prices for the Altair 8800b are \$840 for a kit with complete assembly instructions, and \$1100 for an assembled unit. Complete documentation, membership into the Altair Users Club, subscription to "Computer Notes," access to the Altair Software Library, and a copy of Charles J. Sippl's Microcomputer Dictionary are included. BankAmericard or Master Charge accepted for mail order sales. Include \$8 for postage and handling.

Shouldn't you know more about the Altair 8800b? Send for our free Altair Information Package, or contact one of our many retail Altair Computer Centers.

MITS, Inc. 1976/2450 Alamo S.E. / Albuquerque, New Mexico 87106





Redesigned front panel. Totally synchronous logic design. Same switch and LED arrangement as original Altair 8800. New back-lit Duralith (laminated plastic and mylar, bonded to aluminum) dress panel with multi-color graphics. New longer, flat toggle switches. Five new functions stored on front panel PROM including: DISPLAY ACCUMULATOR (displays contents of accumulator), LOAD ACCUMULATOR (loads contents of the 8 data switches (A7-A0) into accumulator), OUTPUT ACCUMULATOR (Outputs contents of accumulator to I/O device addressed by the upper 8 address switches), INPUT ACCUMULATOR (inputs to the accumulator from the I/O device), and SLOW (causes program execution at a rate of about 5 cycles per second—for program debugging).

Full 18 slot motherboard.

Rugged, commercial grade Optima cabinet.

New front panel interface board buffers all lines to and from 8800b bus.

Two, 34 conductor ribbon cable assemblies. Connects front panel board to front panel interface board. Eliminates need for complicated front panel/bus wiring.

New, heavy duty power supply +8 volts at 18 amps, +18 volts at 2 amps, 18 volts at 2 amps. 110 volt or 220 volt operation (50/60 Hz). Primary tapped for either high or low line operation.

New CPU board with 8080A microprocessor and Intel 8224 clock generator and 8216 bus drivers. Clock pulse widths and phasing as well as frequency are crystal controlled. Compatible with all current Altair 8800 software and hardware.

altair 8800-b

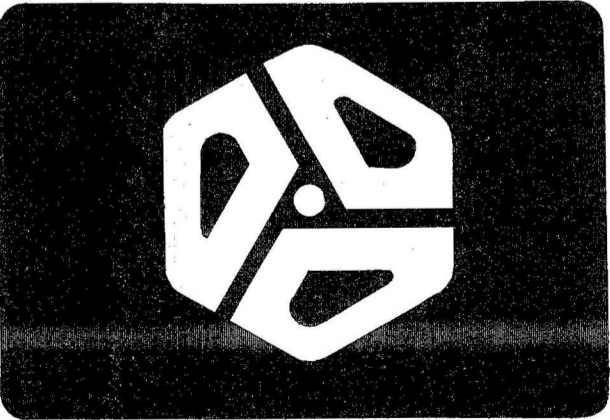


Price, specifications subject to change. Please allow up to 60 days for delivery.

GOOD GRIEF!

This program was adapted from a program appearing in the H-P BASIC Program Library Handbook, June 1972. It will run without modification on both 680 and 8800 8K ALTAIR BASIC.

```
LIST
9000 REM ***** SNOOPY ***** DEMONSTRATION PROGRAM *****
9001 REM *****VERSION 1 *****7/31/69 *****
9002 REM PRINTS A PICTURE OF SNOOPY ON THE TTY
9003 DIM L(60)
9004 FOR T=1 TO 63
9005 LET L(T)=0
9006 NEXT T
9007 LET M=0
9008 READ K,K1
9009 IF K=0 THEN 9018
9010 IF K=1000 THEN 9110
9011 IF K=999 THEN 9112
9012 IF K<M THEN 9014
9013 LET M=K1
9014 FOR Y=K TO K1
9015 LET L(Y)=1
9016 NEXT Y
9017 GOTO 9008
9018 FOR I=1 TO 63 STEP 3
9019 IF I>M THEN 9024
9020 IF L(I)=1 THEN 9027
9021 IF L(I+1)=1 THEN 9038
9022 IF L(I+2)=1 THEN 9043
9023 PRINT " ";
9024 NEXT I
9025 PRINT
9026 GOTO 9004
9027 IF L(I+1)=1 THEN 9031
9028 IF L(I+2)=1 THEN 9036
9029 PRINT " ";
9030 GOTO 9024
9031 IF L(I+2)=1 THEN 9034
9032 PRINT " * ";
9033 GOTO 9024
9034 PRINT "****";
9035 GOTO 9024
9036 PRINT " * * ";
9037 GOTO 9024
9038 IF L(I+2)=1 THEN 9034
9039 PRINT " * * ";
9040 GOTO 9024
9041 PRINT " ****";
9042 GOTO 9024
9043 PRINT " * * ";
9044 GOTO 9024
9045 DATA 999,0
9046 DATA 40,51,-1,-1
9047 DATA 37,51,53,53,-1,-1
9048 DATA 34,49,56,56,-1,-1
9049 DATA 32,47,57,57,-1,-1
9050 DATA 30,45,58,58,-1,-1
9051 DATA 28,43,59,59,-1,-1
9052 DATA 27,41,60,60,-1,-1
9053 DATA 25,39,60,60,-1,-1
9054 DATA 24,37,60,60,-1,-1
9055 DATA 24,35,59,59,-1,-1
9056 DATA 25,32,43,45,58,61,-1,-1
9057 DATA 26,29,41,41,45,45,57,57,62,62,-1,-1
9058 DATA 32,32,40,40,46,46,53,53,-1,-1
9059 DATA 32,32,40,40,46,46,52,52,56,56,-1,-1
9060 DATA 23,23,31,31,39,39,46,46,56,56,-1,-1
9061 DATA 22,22,25,25,38,38,39,39,46,46,56,56,-1,-1
9062 DATA 22,22,26,26,38,38,46,46,56,56,-1,-1
9063 DATA 22,22,27,27,38,38,46,46,56,56,-1,-1
9064 DATA 19,22,28,28,33,33,38,38,45,45,57,57,-1,-1
9065 DATA 15,15,23,23,28,28,32,32,35,35,39,39,44,44,58,58,-1,-1
9066 DATA 13,13,23,23,29,29,32,32,36,36,38,38,44,44,59,59,-1,-1
9067 DATA 12,12,22,22,29,29,32,32,37,39,44,44,60,60,-1,-1
9068 DATA 3,5,11,11,20,23,29,29,32,32,44,44,60,60,-1,-1
9069 DATA 2,2,6,6,10,10,20,23,28,28,32,32,45,45,60,60,-1,-1
9070 DATA 2,2,7,7,20,23,27,27,32,32,46,46,59,59,-1,-1
9071 DATA 2,2,7,7,21,26,31,31,47,47,58,58,-1,-1
9072 DATA 2,4,31,31,51,56,-1,-1
9073 DATA 2,2,31,31,50,55,-1,-1
9074 DATA 2,4,30,30,50,52,54,55,-1,-1
9075 DATA 2,2,8,9,30,30,51,54,-1,-1
9076 DATA 2,4,7,7,10,10,29,29,-1,-1
9077 DATA 3,3,6,6,12,12,27,27,-1,-1
9078 DATA 5,5,15,15,26,26,-1,-1
9079 DATA 17,17,23,23,-1,-1
9080 DATA 18,18,23,23,-1,-1
9081 DATA 16,16,24,24,29,29,31,31,-1,-1
9082 DATA 16,16,24,27,32,32,-1,-1
9083 DATA 17,17,32,32,-1,-1
9084 DATA 18,18,31,31,-1,-1
9085 DATA 20,30,-1,-1
9086 DATA 47,47,-1,-1
9087 DATA 46,46,50,50,-1,-1
9088 DATA 45,45,52,52,-1,-1
9089 DATA 44,44,54,54,-1,-1
9090 DATA 44,44,56,56,-1,-1
9091 DATA 43,43,57,57,-1,-1
9092 DATA 42,42,58,58,-1,-1
9093 DATA 42,42,59,59,-1,-1
9094 DATA 42,42,59,59,-1,-1
9095 DATA 41,41,60,60,-1,-1
9096 DATA 41,41,60,60,-1,-1
9097 DATA 42,42,60,60,-1,-1
9098 DATA 42,42,60,60,-1,-1
9099 DATA 42,42,60,60,-1,-1
9100 DATA 43,43,60,60,-1,-1
9101 DATA 43,43,60,60,-1,-1
9102 DATA 44,44,59,59,-1,-1
9103 DATA 45,45,59,59,-1,-1
9104 DATA 47,47,58,58,-1,-1
9105 DATA 48,48,57,57,-1,-1
9106 DATA 50,50,56,56,-1,-1
9107 DATA 52,52,55,55,-1,-1
9108 DATA 1000,0
9109 DATA 1000,0
9110 PRINT "*****WE HOPE YOU LIKE IT*****"
9111 STOP
9112 PRINT "A PICTURE OF SNOOPY FROM THE ALTAIR 680B SYSTEM"
9113 PRINT
9114 GOTO 9000
9999 END
OK
```



CHANGING CSAVE AND CLOAD I/O PORTS
FOR 8K BASIC (VERSION 3.2)

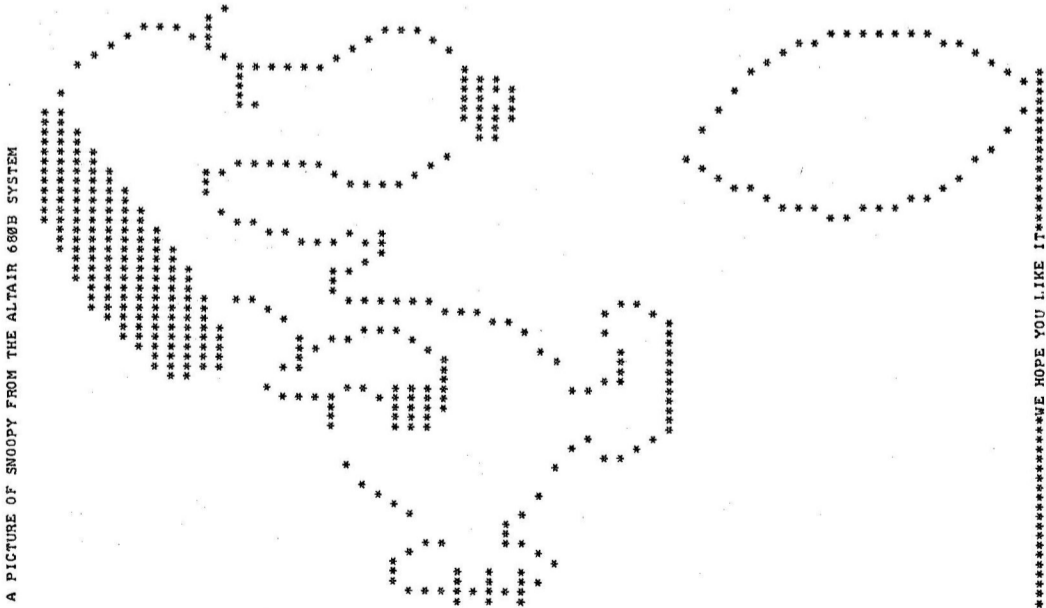
By Tom Durston

By altering locations in 8K BASIC, it is possible to change the ACR "CSAVE" and "CLOAD" I/O ports. You may want to do this to use a different type of storage device for "CSAVE" or "CLOAD" or you may want to use the 2SIO board with the COMTER II.

The following is a listing of the portion of 8K BASIC (version 3.2) that handles "CSAVE" and "CLOAD", and the locations that may be changed. You may change the octal code either by "EXAMINE" and "DEPOSIT", or convert the octal address and code to decimal and use "PEEK" and "POKE". Note that if you POKE incorrectly, you may kill BASIC and will have to reload it.

LOCATION	OCTAL CODE	I/O PORT	2SIO CHANGES
010007	333		
010010	006	CLOAD STATUS PORT	- - - - -
010011	346		
010012	001		
010013	302	- - - - -	312
010014	007		
010015	020		
010016	333		
010017	007	CLOAD DATA PORT	- - - - -
010020	311		
010021	315		
010022	024		
010023	020		
010024	365		
010025	333		
010026	006	CSAVE STATUS PORT	- - - - -
010027	346		
010030	200	- - - - -	002
010031	302	- - - - -	312
010032	025		
010033	020		
010034	361		
010035	323		
010036	007	CSAVE DATA PORT	- - - - -

To find the "CSAVE" and "CLOAD" locations for other versions of BASIC, enter "CLOAD" and carriage return. Then stop the computer and examine the addresses in that vicinity for a pattern similar to the one listed above.



SOFTWARE

JUNE SOFTWARE CONTEST

by Mark Chamberlin

This month's software contest winners were selected from 25 entries that ranged from a Baudot paper tape loader to a program for calculating polynomial fits. Two exceptional subroutines were submitted by Alan Miller -- SOLVIT, which does curve fitting and solves simultaneous equations, took first place in the subroutine category and P PLOT, which produces dual printer plots, won second place. Both subroutines are very well documented.

FIRST PLACE MAJOR PROGRAM

#5-21-761

Author: John Trautschold
Length: 1K bytes
Title: VLCT Octal Monitor
System monitor for use with VLCT.

SECOND PLACE MAJOR PROGRAM

#6-11-761

Author: Roger Frank
Length: 10 lines BASIC
Title: Tape ID
Determines and prints the CSAVE character for CSAVED files.

THIRD PLACE MAJOR PROGRAM

#5-24-761

Author: Joe Konrad
Length: 79 lines BASIC
Title: Radio Code
Produces Morse radio code. Includes a schematic for a tone oscillator to be used by the program.

FIRST PLACE SUBROUTINE

#5-17-761

Author: Alan Miller
Length: 24 lines BASIC
Title: SOLVIT
Subroutine for curve fitting and solution of simultaneous equations.

SECOND PLACE SUBROUTINE

#6-3-761

Author: Alan Miller
Length: 40 lines BASIC
Title: P PLOT
Produces dual printer plots.

#5-24-762

Author: Walter King
Length: 50 bytes
Title: Baudot 5-Level Tape Loader
Loads object code from 5-level paper tape.

#5-24-765

Author: Walter King
Length: 71 bytes
Title: Baudot 5-Level Tape Dumper
Punches 5-level object tapes which can be read by #5-24-762.

#5-20-761

Author: Bill Thompson
Length: 168 lines BASIC
Title: Annuity Calculations
Interesting program for interest calculations.

#5-20-762

Author: Bill Thompson
Length: 224 lines BASIC
Title: Annuity Calculations #2
Same as #5-20-761 except uses WRITE and FORMAT (HP BASIC) instead of PRINT USING.

#5-20-763

Author: Bill Thompson
Length: 48 lines BASIC
Title: Savings
Calculates the total yield of an investment.

#5-20-764

Author: Bill Thompson
Length: 47 lines BASIC
Title: True Annual Interest
Calculates the true annual interest rate charges on an installment loan.

#5-20-765

Author: Bill Thompson
Length: 103 lines
Title: Cash Flow and Discounted Rate of Return
Calculates cash flow and discounted rate of return.

#5-20-766

Author: Bill Thompson
Length: 212 lines
Title: Polynomial Curve Fit
Calculates polynomial fit using least-squares approximation method.

#6-2-761

Author: Alan Miller
Length: 1K bytes
Title: PROM on 1K
System Monitor for 1K of PROM or RAM. An extension of #3-22-761.

#6-14-761

Author: Roy Hann and Alan Menezes
Length: 146 lines BASIC
Title: Lunar Landing Game
Plays an extended version of Lunar Lander.

#5-27-761

Author: George Rompot
Length: 180 bytes
Title: JAMON Mods-Hex Input & Output
Adds hexadecimal input and output to JAMON while retaining present octal capabilities.

#6-1-761

Author: Dale Travis
Length: 32 lines BASIC
Title: Lister
Reads paper tapes and produces a page formatted listing.

#6-1-762

Author: Dale Travis
Length: 103 lines BASIC
Title: Square
Plays the game of Square.

#6-1-763

Author: Dale Travis
Length: 97 lines BASIC
Title: Kingdom
Plays the game of Kingdom.

#6-2-764

Author: Dale Travis
Length: 159 lines BASIC
Title: Dodgem
Plays the game of Dodgem.

#6-16-761

Author: Martin Eastburn
Length: 32 bytes
Title: Super Time Counter
Generates program time delays with accuracy to ± 1 sec/min.

#6-7-761

Author: Herb Archer
Length: 128 bytes
Title: Pong
Players paddle a bit across the front panel LEDs.

#5-25-761

Author: Robert Wilcox
Length: 35 lines BASIC
Title: Punch Tape Label Program
Punches human-readable labels on ASR33 paper tape.

#5-25-762

Author: Robert Wilcox
Length: 40 lines BASIC
Title: Punch Tape Label Program #2
Fancy version of #5-25-761. Punches leader, label, and more leader.

#6-14-762

Author: Jim Salem
Length: 55 bytes
Title: Keyload
A simple ASCII-to-octal keyboard loader.

May Software Contest Corrections

Last month's Software Contest listed an incorrect program number for "Horse Race," submitted by Erik Mueller. The correct number is #4-27-765 (not #4-27-764).

The correct program number for Jim Gerow's 6800 Cross Assembler is #5-24-763 (not #5-29-763).

Also, two programs were accepted into the library last month that were omitted from the Software Contest listing. They are:

#5-3-762

Author: Mitchell Wolrich
Length: 107 lines BASIC
Title: Missile Plane
Game in which one player flies a plane and the other player tries to shoot him down with a missile.

#5-14-761

Author: Paul Krystosek
Length: 196 bytes
Title: Morse Code Sending from Keyboard

Software Initialization of Parallel and Serial I/O Boards

By Patrick N. Godding

In an attempt to encompass as many different applications as possible, MITS has created two new peripheral interface boards, the 88-4PIO and the 88-2SIO. The boards are extremely versatile, which has led to some confusion in their software initialization requirements. This article will help to explain the software operation of the boards.

88-4PIO

NOTE: All address references are in octal.

There are two sections in each port, "A" and "B", and three registers in each section of each port: the Control Register, the Data Direction Register and the Data Register.

The Control Register is always accessed by an even address (address line A₀ = 0). Assume an 88-4PIO with only one port, addressed at starting location 020. In this case, the "A" Section Control Register is 020 and the "B" Section Control Register is 022. Execution of an input instruction (INP = 333) followed by an I/O address of 020 would transfer the contents of the "A" Section Control Register into the accumulator. Execution of an output instruction (OUT = 323) followed by an I/O address of 022 would transfer the contents of the accumulator into the "B" Section Control Register.

The Data Direction Register and the Data Register have the same address: using the above example, the "A" Section Data Direction Register and the Data Register are at address 021 and the "B" Section Data Direction Register and Data Register are at address 023. These addresses are always odd (A₀ = 1). The Control Register determines which one of the other two Registers will be selected:

Control Register Bit 2	I/O Address	Register Selected
Zero (0)	0 2 1	"A" Section Data Direction
Zero (0)	0 2 3	"B" Section Data Direction
One (1)	0 2 1	"A" Section Data Register
One (1)	0 2 3	"B" Section Data Register

This brings us to the first step of the Port Initialization: write a zero into bit 2 of both Control Registers. In fact, since at this point the other bits of the Control Registers have no effect, simply write the Registers with all zeros:

```

076    Load Accumulator with zeros
000
323    Output zeros to "A" and "B"
020    Section Control Registers
323
022

```

When the above routine has been executed, an I/O instruction followed by the even address will select one of the Data Direction Registers (DDR). The DDR has only one purpose: to define each of the data lines as an input or an output. Normally this Register is accessed only during initialization. It is an 8-bit, write-only register with each bit defining a particular data line: Bit 0 defines data line 0, etc. When a DDR bit is set to a one, the associated data line acts as an output. When the DDR bit is reset to a zero, the data line acts as an input.

Suppose we wish to interface a parallel keyboard and CRT display unit with the port. The routine given below sets up the "A" Section to act as an 8-bit input for the keyboard and the "B" Section to act as an 8-bit output for the CRT:

Note that this is a continuation of the above program and the accumulator is zeroed.

```

323    Output zeros to the "A" Section DDR
021    to make the data lines inputs
076    Load accumulator with ones
377
323    Output ones to "B" Section DDR to
023    make data lines outputs

```

The above sequence is only an example. Any combination of inputs and outputs is possible: e.g., the "A" Section could be set up for 4 inputs and 4 outputs and the "B" Section for 8 inputs, giving a total of 12 inputs and 4 outputs.

When one section is going to be used for input and the other for output, it might be desirable to use the "B" Section as output because not only is it TTL compatible (as the "A" Section is) but it also has higher sourcing current. This means that it can directly drive a transistor switch by sourcing 1 milliamp at a minimum of 1.5 volts. One application would be interfacing to a device using relays for its inputs. The "B" Section could directly drive transistors used to turn the relay coils on and off.

The last step in the initialization is to again write into the Control Registers. All the data bits of the Control Register are important for this final write. Remember that we're using address 020, so that the "A" Section Control Register is address 020 and the "B" Section Control Register is 022.

Before explaining the effect that the Control bits have on the operation of the port, let's briefly discuss terminal interface communications. Assume that we have a keyboard and a printer. We are going to interface the keyboard to the "A" Section of the port and the printer to the "B" Section. The keyboard produces 7 data bits with each key stroke and a strobe pulse signaling when a key is active. The strobe pulse becomes a "Handshake" signal to inform the CPU when there is valid data at the input section. The keyboard also has an input for a busy signal. Once a key is depressed and the strobe signal is sent, it is up to the port to maintain a busy signal back to the keyboard until the data has been received by the CPU. After the receipt of the valid data signal the CPU inputs the data and resets the busy signal indicating that it is ready to receive new data from the keyboard.

The printer operates in a similar manner. When the printer is ready to receive new data it indicates this by a ready-to-receive signal to the interface port. When the CPU receives this signal it sends out valid data along with a signal indicating to the printer that there is valid data. Once the data has been received by the printer it again sends out its ready-to-receive signal which then resets the CPU valid data signal. (See block diagram.)

The table below shows the bit function for the control registers.

Bit #	7	6	5	4	3	2	1	0
Function	Interrupt Request		C2 Control			DDR Control	C1 Control	

continued

Software Initialization

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The bits of both the "A" and "B" Section Control Register are defined in the tables below:

CONTROL BITS 1 0		C1 INPUT	STATUS BIT 7	TRQ OUTPUT
0	1	Active low	Set high when C1 is active	Disabled -- remains high
0	1	Active low	Set high when C1 is active	Goes low when bit 7 goes high
1	0	Active high	Set high when C1 is active	Disabled -- remains high
1	1	Active high	Set high when C1 is active	Goes low when bit 7 goes high

CONTROL BITS 5 4 3			C2	STATUS BIT 6	TRQ
0	0	0	Active low	Set high when C2 is active	Disabled -- remains high
0	0	1	Active low	Set high when C2 is active	Goes low when bit 7 is high
0	1	0	Active high	Set high when C2 is active	Disabled -- remains high
0	1	1	Active high	Set high when C2 is active	Goes low when bit 7 is high

B SECTION CONTROL BITS			CB2	
5	4	3	CLEARED	SET
1	0	0	Low when E pulse goes high, following a write of B data channel	High when CB1 is active
1	0	1	Low When E pulse goes high, following a write of B data channel	High when next E pulse goes high
1	1	0	Always low when bit 3 is low	
1	1	1		Always high when bit 3 is high

A SECTION CONTROL BITS			CA2	
5	4	3	CLEARED	SET
1	0	0	Low after E pulse, following read of A data channel	High when CA1 is active
1	0	1	Low after a read of A data channel	High following next E pulse
1	1	0	Always low when bit 3 is low	
1	1	1		Always high when bit 3 is high

As an example of the use of these tables, consider the keyboard/printer discussed above. The complete initialization of the port for the "A" and "B" Sections is given below, with particular emphasis on the control word of each section.

First we must designate the "A" Section as the Input Mode and the "B" Section as the Output Mode.

```

076    Load accumulator with zeros
000

323    Output
020    "A" Section Control

323    Output
022    "B" Section Control

323    Output
021    "A" Section DDR

076    Load accumulator with ones
377

323    Output
023    "B" Section DDR

```

Access Data Direction Register and set up all "A" Section data lines as inputs and "B" Section data lines as outputs.

"A" SECTION CONTROL WORD

```

076    Bits 0 and 1 equal 0 and 1 respectively -
046    making CA1 low (active) and disabling inter-
323    rupts. Bit 2 equals a 1 - enable the Data
020    Register. Bits 3, 4, and 5 equal 001 re-
        spectively - defining CA2 as an output to
        act as a busy signal to the keyboard.

```

CA2 will go low when the keyboard strobe signal forces the C1 input active. CA2 will go back high after the CPU reads the "A" Section Data Channel. In this application the CA2 signal indicates the CPU is busy when it is low. When it is high the keyboard is free to send new data.

"B" SECTION CONTROL WORD

```

076    Again bits 0 and 1 equal 0 and 1 and operate
045    as in the above "A" Section.
323    Bit 2 equals 1 - enable the "B" Data Register.
022    Bits 3, 4, and 5 define CB2 as an output busy
        signal to the printer. The printer pulls CB1
        low when it is ready for new data. This
        action causes CB2 to go high, indicating that
        the CPU is busy. When the CPU writes a data
        word out to the printer, CB2 goes low to tell
        the printer that valid data is available.

```

CPU OPERATION

Bits 6 and 7 of the Control Register operate as status bits in the above example. Since CA2 and CB2 are used as outputs, status bit 6 is not used. The following routine is an echo program which inputs a character from the keyboard and then outputs the character to the printer. The CPU monitors status bit 7 for indication that data is available from an input section or the output section is ready to receive data.

Assume that the port has been initialized per the above routine.

```

000    333    Input
001    020    "A" Section Control Register

002    346    AND Immediate
003    200    Bit 7

004    312    Jump if result zero
005    000    to location 0
006    000

007    333    Input
010    021    "A" Section Data Register

011    062    Store Accumulator
012    100    at location 100
013    000

014    333    Input
015    022    "B" Section Control Register

016    346    AND Immediate
017    200    Bit 7

020    312    Jump if zero
021    014    to location 014
022    000

023    072    Load Accumulator
024    100    from location 100
025    000

026    323    Output
027    023    "B" Section Data Register

030    333    Input
031    023    "B" Section Data Register

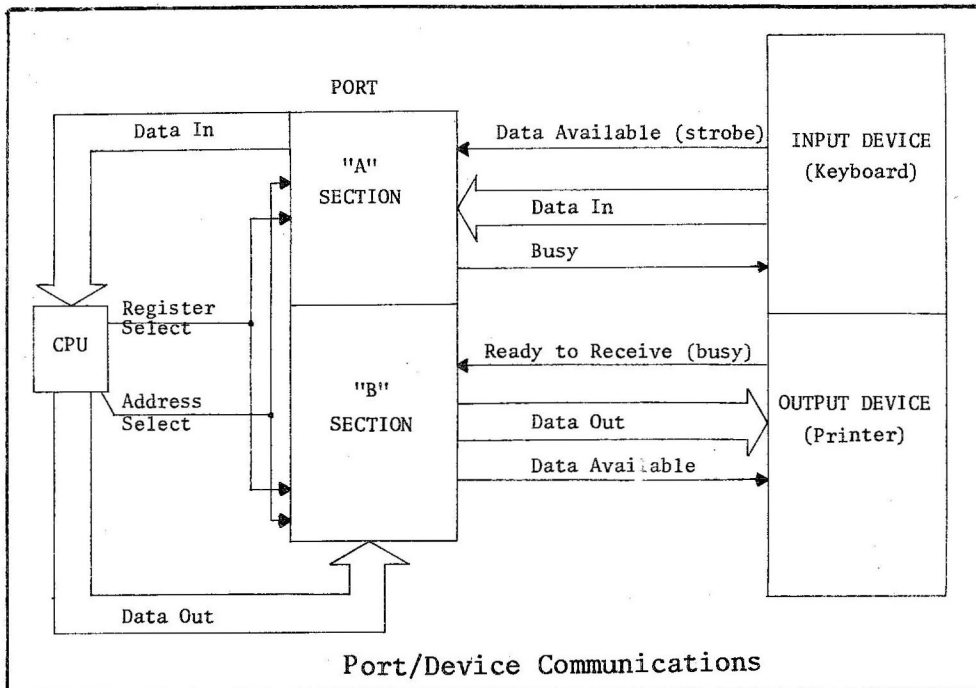
032    303    Jump unconditional
033    000    to location 0
034    000

```

continued on page 16

Software Initialization continued from page 15

Execution of this program causes the following: "A" Section Control Register is input to the accumulator and tested to see if bit 7 has gone high. If high, "A" Section Data Channel is input to the accumulator and then stored at location 100. Then the "B" Section Control Register is tested to see if bit 7 is high. If it is, it indicates that the printer is not busy and the stored character is then loaded from location 100 into the accumulator and output to the "B" Section Data Channel. Then the "B" Section Data Register must be input to clear the status flag, bit 7. The program then jumps to the beginning to wait for a new character.



This has been a description of one port. The 88-4PIO has provisions for a total of four ports, each operating identically to the above port. The only addition for the extra ports is the I/O address used for Register selection. The complete addressing for 4 ports on the above board (starting address 020) is as follows:

PORT #	SECTION	ADDRESS	REGISTER
0	A	0 2 0	Control
		0 2 1	Data
	B	0 2 2	Control
		0 2 3	Data
1	A	0 2 4	Control
		0 2 5	Data
	B	0 2 6	Control
		0 2 7	Data
2	A	0 3 0	Control
		0 3 1	Data
	B	0 3 2	Control
		0 3 3	Data
3	A	0 3 4	Control
		0 3 5	Data
	B	0 3 6	Control
		0 3 7	Data

88-2SIO

Each port on the 88-2SIO contains two Registers: a Control/Status Register and a Data In/Out Register. As with the 88-4PIO, the ports must be initialized. The access scheme is the same as the 4PIO. The Control/Status Register is the even address ($A0 = 0$) and the Data I/O Register is the odd address ($A0 = 1$).

Assume the board is addressed at starting location 010. Then the Register addresses become:

010	Control/Status Register	Port 0
011	Data I/O Register	Port 0
012	Control/Status Register	Port 1
013	Data I/O Register	Port 1

The first step in initialization is to reset the port. This is accomplished by writing a 1 into the first two bits of the Control Register:

```
076
003  Write 1's into bit 0 and bit 1 of
323  the Control Register
010
```

BIT	7	6	5	4	3	2	1	0
FUNCTION	REC INT	X-MIT	INT	WORD SELECT		RESET/DIVIDE		

The table above shows the bit functions of the control register.

The next step is to define the clock divide ratio. The on-board clock generator produces a frequency that is 16 times the actual baud rate (the rate marked 110 on the board is actually 16 times 110, or 1760 Hertz). If the baud rate needed for your particular terminal is one of the baud rates marked on the board, use the $\div 16$ mode. If the baud rate needed is one of the other five available (27.5, 37.5, 75, 450 or 600), use the $\div 64$ mode. Page 5 of the 88-2SIO Theory Manual shows which rate to select on the board for the above five rates. Note that both the baud rate and the word select are a function of the I/O device being used. The port is programmed to be compatible with the device, not vice-versa.

The chart below shows the function of bits 0 and 1.

BIT 1	BIT 0	FUNCTION
0	0	\div Clock by 1
0	1	\div Clock by 16
1	0	\div Clock by 64
1	1	Master Reset

Bits 2, 3, and 4 define the form of the serial word transmitted and received. Again, this is a function of the device. An example is a Teletype that has a reader and punch (ASR). The port should be programmed for 8 data bits, 2 stop bits and no parity. The chart below shows the serial word combinations available:

DATA BIT			FUNCTION		
4	3	2	Number of Data Bits	Number of Stop Bits	Parity
0	0	0	7	2	Even
0	0	1	7	2	Odd
0	1	0	7	1	Even
0	1	1	7	1	Odd
1	0	0	8	2	None
1	0	1	8	1	None
1	1	0	8	1	Even
1	1	1	8	1	Odd

continued

Software Initialization

continued from page 16

Bits 5 and 6 control the transmit interrupt and the Request-To-Send (RTS) output signal. The RTS signal is used to turn the reader on and off, under software control, on the new TYA Kit. With the 2SIO, a "Handshake" type communication previously described in the 4PIO operation is usually not needed. When the port receives a serial data word and converts it to parallel for the CPU, a status flag is automatically set to indicate valid data and if interrupts are enabled, it also generates an interrupt. The transmit portion works in the same way. Normally, the "Handshake" signals on the 2SIO would only be used in a modem connection. This is also true with terminals. There is generally no need for handshake signals in a single-user, stand-alone system. This is why the 88-2SIO Manual indicates that if CTS and DCD are not needed, which is usually the case, connect them directly to ground (at the D and E pads) and to nothing else.

Bit 7 controls the receive interrupt.

DATA BIT			FUNCTION
7	6	5	
X	0	0	RTS = low, transmitting interrupt disabled.
X	0	1	RTS = low, transmitting interrupt enabled.
X	1	0	RTS = high, transmitting interrupt disabled.
X	1	1	RTS = high, transmits a break level on the transmit data output. Transmit interrupt disabled.
0	X	X	Receive interrupt disabled.
1	X	X	Receive interrupt enabled.
X = does not matter.			

The example below shows the complete control word for a CRT terminal that operates at 9600 baud, uses 7 data bits, 1 stop bit and even parity. This example disables both receive and transmit interrupts:

Control Bit	7	6	5	4	3	2	1	0
State	0	1	0	0	1	0	0	1

Thus, to initialize the port:

```
076 Load
111 Control Word
323 Out
010 Control Register
```

Remember that the previous output for resetting the port has been executed prior to this initialization.

The CPU looks at status information exactly the same as with the 4PIO, but the pertinent bits are in a different location within the status register.

STATUS REGISTER BIT #	FUNCTION
0	Receive Data Register full - when high, indicates that valid data is ready to be input into the accumulator.
1	Transmit Data Register empty - when high, indicates that the CPU may output data.

We can now write an echo program for port 0 of a 2SIO at starting address 010:

```
000 333 Input
001 010 Status Register
002 346 AND Accumulator
003 001 with bit 0
004 312 Jump if no data
005 000 to 0
006 000
007 333 Input
010 011 Data Register
011 062 Store at
012 100 100
013 000
014 333 Input
015 010 Status Register
016 346 AND with
017 002 bit 1
020 312 Jump if buffer
021 014 full to 14
022 000
023 072 Load from
024 100 100
025 000
026 323 Out to
027 011 Data Register
030 303 Jump to get
031 000 new data
032 000
```

Hopefully, this information has cleared up some misconceptions about the I/O boards. The software is a little more complex, but this allows hardware compatibility with many different devices, and also allows interfacing more than one device per card.

SPECIAL NOTE: With the new I/O boards, a program cannot interrupt from a Halt state. A mod to change this exists, but is fairly complex. If your application does not lend itself to changing the Halt instruction to a Jump-self instruction, please contact me and I'll be happy to send you the mod.

Patrick N. Godding
Program Manager



AFFIX COMPUTER NOTES LABEL
HERE

ADDRESS CHANGES

Send notification of change of address to the attention of Customer Service/MITS, Inc./ 2450 Alamo SE/Albuquerque, NM 87106. Include your most recent mailing label from Computer Notes. Allow 4-6 weeks.

Notification of Change of Address

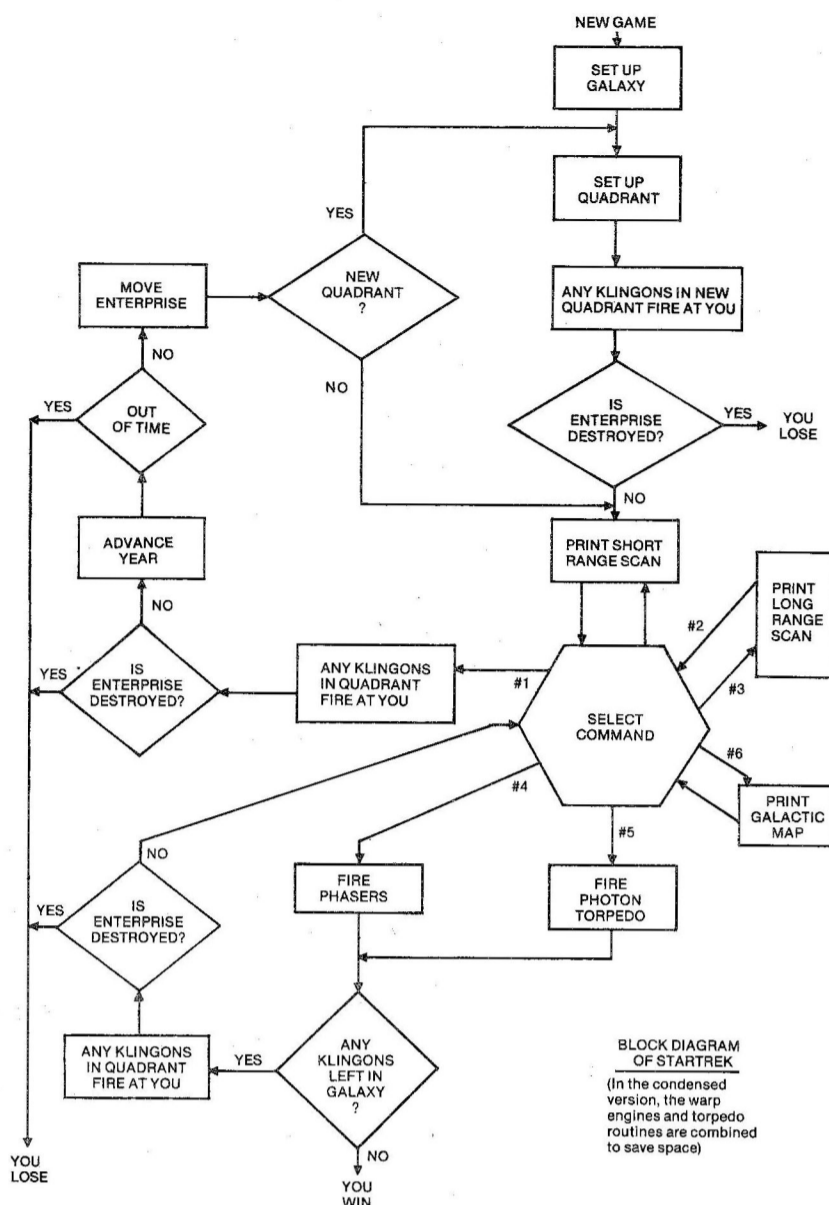
NEW ADDRESS:

NAME _____

ADDRESS _____ APT. # _____

CITY _____ STATE _____ ZIP _____

STAR TREK LIVES!



BLOCK DIAGRAM
OF STARTREK
(In the condensed
version, the warp
engines and torpedo
routines are combined
to save space)

NULL 0
CLEAR 50
NEW

```
10 REM ** STARTREK ** (3/14/76)
10 REM A GAME OF INTRAGALACTIC WARFARE BASED ON NBC'S POPULAR TV SHOW
10 REM ADAPTED FOR ALTAIR 8K BASIC (VERSION 3.1) BY L E COCHRAN
10 REM AND REWRITTEN TO FIT (WITH 8K BASIC) WITHIN 12K OF MEMORY
10 REM (EXPECT A 4 SEC PAUSE TO SET UP EACH QUADRANT, AND
10 REM 10 SEC AFTER "WORKING")
```

```
10 DIM D(5), K1(7), K2(7), K3(7), S(7,7), Q(7,7), D$(5)
20 Q$="EKB*"
30 D$(0)="WARP ENGINES"
40 D$(1)="SHORT RANGE SENSORS"
50 D$(2)="LONG RANGE SENSORS"
60 D$(3)="PHASERS"
70 D$(4)="PHOTON TORPEDOES": D$(5)="GALACTIC RECORDS"
80 INPUT "PLEASE ENTER A RANDOM NUMBER": E$: I=ASC(E$)
90 I=I-11*INT(I/11): FOR J=0 TO 1: K=RND(1): NEXT: PRINT "WORKING--"
100 DEF FND(N)=SQR((K1(I)-S1)^2+(K2(I)-S2)^2)
110 GOSUB 610: GOSUB 450: Q1=X: Q2=Y: X=S: Y=1: X1= 2075: Y1=6.28: X2=3.28
120 Y2=1.8: A= .96: C=100: W=10: K9=0: B9=0: S9=400: T9=3451: GOTO 140
130 K=K+(NCX2)+(NCY2)+(NC.28)+(NC.08)+(NC.03)+(NC.01): K9=K9-K: GOTO 160
140 T0=3421: T=T0: E0=4000: E=E0: P0=10: P=P0: FOR I=0 TO 7
150 FOR J=0 TO 7: K=0: N=RND(Y): IF NCX1 THEN N=N*64: K=(NCY1)-Y: GOTO 130
160 B=(RND(Y)*A): B9=B9-B: Q(I,J)=K+C+B*W-INT(RND(Y)*X+Y): NEXT J, I
170 IF K9>(T9-T0) THEN T9=T0+K9
180 IF B9>0 THEN 200
190 GOSUB 450: Q(X,Y)=Q(X,Y)-10: B9=1
200 PRINT LEFT$("STARTREK ADAPTED BY L. E. COCHRAN 2/29/76", 8): K0=K9
210 PRINT "OBJECTIVE: DESTROY": K9: "KLINGON BATTLE CRUISERS IN": T9-T0:
220 PRINT "YEARS.": PRINT "THE NUMBER OF STARBASES IS": B9
230 A=0: IF Q1<0 OR Q1>7 OR Q2<0 OR Q2>7 THEN N=0: S=0: K=0: GOTO 250
240 N=ABS(Q(Q1,Q2)): Q(Q1,Q2)=N: S=N-INT(N/10)*10: K=INT(N/100)
250 B=INT(N/10-K*10): GOSUB 450: S1=X: S2=Y
260 FOR I=0 TO 7: FOR J=0 TO 7: S(I,J)=1: NEXT J, I: S(S1,S2)=2
270 FOR I=0 TO 7: K3(I)=0: X=8: IF I<K THEN GOSUB 460: S(X,Y)=3: K3(I)=59
280 K1(I)=X: K2(I)=Y: NEXT: I=S
290 IF B>0 THEN GOSUB 460: S(X,Y)=4
300 IF I>0 THEN GOSUB 460: S(X,Y)=5: I=I-1: GOTO 300
310 GOSUB 550: IF A=0 THEN GOSUB 480
320 IF E<0 THEN 1370
330 I=1: IF D(I)>0 THEN 620
340 FOR I=0 TO 7: FOR J=0 TO 7: PRINT MID$(Q$(S(I,J),1), 1): " ": NEXT J
350 PRINT " ": ON I GOTO 380, 390, 400, 410, 420, 430, 440
360 PRINT "YEARS =": T9-T
370 NEXT: GOTO 650
380 PRINT "STARDATE=": T: GOTO 370
390 PRINT "CONDITION: ": C$: GOTO 370
400 PRINT "QUADRANT=": Q1+1: "-": Q2+1: GOTO 370
410 PRINT "SECTOR=": S1+1: "-": S2+1: GOTO 370
420 PRINT "ENERGY=": E: GOTO 370
430 PRINT D$(4): " ": P: GOTO 370
440 PRINT "KLINGONS LEFT=": K9: GOTO 370
450 X=INT(RND(1)*8): Y=INT(RND(1)*8): RETURN
460 GOSUB 450: IF S(X,Y)>1 THEN 460
470 RETURN
```

```
480 IF K<1 THEN RETURN
490 IF C$="DOCKED" THEN PRINT "STARBASE PROTECTS ENTERPRISE": RETURN
500 FOR I=0 TO 7: IF K3(I)<=0 THEN NEXT: RETURN
510 H=K3(I)*.4*RND(1): K3(I)=K3(I)-H: H=H/(FND(0)^.4): E=E-H
520 E$="ENTERPRISE FROM": N=E: GOSUB 530: NEXT: RETURN
530 PRINT H: "UNIT HIT ON ": E$: " SECTOR": K1(I)+1: "-": K2(I)+1:
540 PRINT " ": N: "LEFT": RETURN
550 FOR I=S1-1 TO S1+1: FOR J=S2-1 TO S2+1
560 IF I<0 OR I>7 OR J<0 OR J>7 THEN 580
570 IF S(I,J)=4 THEN C$="DOCKED": E=E0: P=P0: GOSUB 610: RETURN
580 NEXT J, I: IF K>0 THEN C$="RED": RETURN
590 IF E<E0*.1 THEN C$="YELLOW": RETURN
600 C$="GREEN": RETURN
610 FOR N=0 TO 5: D(N)=0: NEXT: RETURN
620 PRINT D$(I): " DAMAGED. ":
630 PRINT " ": D(I): "YEARS ESTIMATED FOR REPAIR. ": PRINT
640 IF A=1 THEN RETURN
650 INPUT "COMMAND": A
660 IF A<1 OR A>6 THEN 680
670 ON A GOTO 710, 310, 1250, 1140, 690, 1300
680 FOR I=0 TO 5: PRINT I+1: " ": D$(I): NEXT: GOTO 650
690 IF D(4)>0 THEN PRINT "SPACE CRUD BLOCKING TUBES. ": I=4: GOTO 630
700 N=15: IF P<1 THEN PRINT "NO TORPEDOES LEFT": GOTO 650
710 IF A=5 THEN PRINT "TORPEDO ":
720 INPUT "COURSE (1-8.9)": C: IF C<1 THEN 650
730 IF C>9 THEN 710
740 IF A=5 THEN P=P-1: PRINT "TRACK. ": GOTO 900
750 INPUT "WARP (0-12)": W: IF W<0 OR W>12 THEN 710
760 IF W<=2 OR D(0)<=0 THEN 780
770 I=0: PRINT D$(I): " DAMAGED, MAX IS .2 ": GOSUB 630: GOTO 750
780 GOSUB 480: IF E<=0 THEN 1370
790 IF RND(1)>.25 THEN 870
800 X=INT(RND(1)*6): IF RND(1)>.5 THEN 830
810 D(X)=D(X)+INT(6-RND(1)*5): PRINT "**SPACE STORM. ":
820 PRINT D$(X): " DAMAGED**": I=X: GOSUB 630: D(X)=D(X)+1: GOTO 870
830 FOR I=X TO 5: IF D(I)>0 THEN 860
840 NEXT
850 FOR I=0 TO X: IF D(I)<=0 THEN NEXT: GOTO 870
860 D(I)=5: PRINT "**SPOCK USED A NEW REPAIR TECHNIQUE**"
870 FOR I=0 TO 5: IF D(I)=0 THEN 890
880 D(I)=D(I)-1: IF D(I)<=0 THEN D(I)=0: PRINT D$(I): " ARE FIXED!"
890 NEXT: N=INT(W*8): E=E-N-N+.5: T=T+1: S(S1,S2)=1
900 Y1=S1+.5: X1=S2+.5: IF T>T9 THEN 1370
910 Y=(C-1)*.785398: X=COS(Y): Y=-SIN(Y)
920 FOR I=1 TO N: Y1=Y1+Y: X1=X1+X: Y2=INT(Y1): X2=INT(X1)
930 IF X2<0 OR X2>7 OR Y2<0 OR Y2>7 THEN 1110
940 IF A=5 THEN PRINT Y2+1: "-": X2+1:
950 IF S(Y2,X2)=1 THEN NEXT: GOTO 1060
960 PRINT: IF A=1 THEN PRINT "BLOCKED BY ":
970 ON S(Y2,X2)-3 GOTO 1040, 1020
980 PRINT "KLINGON": IF A=1 THEN 1050
990 FOR I=0 TO 7: IF Y2<K1(I) THEN 1010
1000 IF X2=K2(I) THEN K3(I)=0
1010 NEXT: K=K-1: K9=K9-1: GOTO 1070
1020 PRINT "STAR": IF A=5 THEN S=S-1: GOTO 1070
1030 GOTO 1050: 2L29E76C
1040 PRINT "STARBASE": IF A=5 THEN B=2: GOTO 1070
1050 PRINT " AT SECTOR": Y2+1: "-": X2+1: Y2=INT(Y1-Y): X2=INT(X1-X)
1060 S1=Y2: S2=X2: S(S1,S2)=2: A=2: GOTO 310
1070 PRINT " DESTROYED!": IF B=2 THEN B=0: PRINT " . . . GOOD WORK!":
1080 PRINT: S(Y2,X2)=1: Q(Q1,Q2)=K*100+B*10+S: IF K9<1 THEN 1400
1090 GOSUB 480: IF E<=0 THEN 1370
1100 GOSUB 550: GOTO 650
1110 IF A=5 THEN PRINT "MISSED!": GOTO 1090
1120 Q1=INT(Q1+W*Y+(S1+.5)/8): Q2=INT(Q2+W*X+(S2+.5)/8)
1130 Q1=Q1-(Q1<0)+(Q1>7): Q2=Q2-(Q2<0)+(Q2>7): GOTO 230
1140 I=3: IF D(I)>0 THEN 620
1150 INPUT "PHASERS READY: ENERGY UNITS TO FIRE": X: IF X<=0 THEN 650
1160 IF X>E THEN PRINT "ONLY GOT": E: GOTO 1150
1170 E=E-X: Y=K: FOR I=0 TO 7: IF K3(I)<=0 THEN 1230
1180 H=X/(Y*(FND(0)^.4)): K3(I)=K3(I)-H
1190 E$="KLINGON AT": N=K3(I): GOSUB 530
1200 IF K3(I)>0 THEN 1230
1210 PRINT "**KLINGON DESTROYED**"
1220 K=K-1: K9=K9-1: S(K1(I),K2(I))=1: Q(Q1,Q2)=Q(Q1,Q2)-100
1230 NEXT: IF K9<1 THEN 1400
1240 GOTO 1090
1250 I=2: IF D(I)>0 THEN 620
1260 PRINT D$(I): " FOR QUADRANT": Q1+1: "-": Q2+1
1270 FOR I=Q1-1 TO Q1+1: FOR J=Q2-1 TO Q2+1: PRINT " ":
1280 IF I<0 OR I>7 OR J<0 OR J>7 THEN PRINT "***": GOTO 1350
1290 Q(I,J)=ABS(Q(I,J)): GOTO 1340
1300 I=5: IF D(I)>0 THEN 620
1310 PRINT "CUMULATIVE GALACTIC MAP FOR STARDATE": T
1320 FOR I=0 TO 7: FOR J=0 TO 7: PRINT " ":
1330 IF Q(I,J)<0 THEN PRINT "***": GOTO 1350
1340 E$=STR$(Q(I,J)): E$="00"+MID$(E$, 2): PRINT RIGHT$(E$, 3):
1350 NEXT J: PRINT: NEXT I: GOTO 650
1360 PRINT: PRINT "IT IS STARDATE": T: RETURN
1370 GOSUB 1360: PRINT "THANKS TO YOUR BUNGLING, THE FEDERATION WILL BE"
1380 PRINT "CONQUERED BY THE REMAINING": K9: "KLINGON CRUISERS!"
1390 PRINT "YOU ARE DEMOTED TO CABIN BOY!": GOTO 1430
1400 GOSUB 1360: PRINT "THE FEDERATION HAS BEEN SAVED!"
1410 PRINT "YOU ARE PROMOTED TO ADMIRAL": PRINT K0: "KLINGONS IN":
1420 PRINT T-T0: "YEARS. RATING=": INT(K0/(T-T0)*1000)
1430 INPUT "TRY AGAIN": E$: IF LEFT$(E$, 1)="Y" THEN 110
```

Something Sweet for your altair^{T.M.} 680-b

MITS is pleased to announce the development of a 16K static card for the Altair 680b. With an access time of 215 nanoseconds and low power consumption of 5 watts, we feel that this is an excellent addition to the Altair 680b.

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Altair 680 BASIC is identical to the 8K BASIC developed for the Altair 8800. Features include Boolean operators, the ability to read or write a byte from any I/O port or memory location, multiple statements per line, and the ability to interrupt program execution and then continue after the examination of variable values.

Other features of Altair 680 BASIC include variable length strings (up to 255 characters), with LEFT\$, RIGHT\$ and MID\$ functions, a concatenation operator and VAL and STR\$ to convert between strings and numbers. Both string and numeric arrays of up to 30 dimensions can be used. Nesting of loops and subroutine calls is limited only by available memory. Intrinsic functions include: SIN, COS, TAN, LOG, EXP, SQR, SGN, ABS, INT, FRE, RND and POS, in addition to TAB and SPC in PRINT statements. Altair 680 BASIC takes 7K bytes of memory.

MITS has also developed an expander card for the Altair 680b that lets you add up to three boards inside the main case. Read "Computer Notes" for announcements of additional Altair 680b boards.

PRICES:

Altair 680-BSM, 16K Static Memory Board, including Altair 680 BASIC, assembler and text editor	\$685.00 kit
	\$865.00 assembled
Altair 680-MB Expander Card with one Edge Connector	\$24.00 kit
Altair 680 BASIC (purchased separately)	\$200.00
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